



# TM 5-4120-270-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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**OPERATOR, ORGANIZATIONAL, DS, GS, AND DEPOT  
MAINTENANCE MANUAL**

**AIR CONDITIONER:  
COMPACT VERTICAL  
208V, 3 PHASE, 60,000 BTUH COOLING;  
49,000 BTUH HEATING  
(TRANE MODELS)  
50/60 CYCLE—MODEL MAC6V60-360-2  
FSN 4120-935-5416  
400 CYCLE—MODEL MAC4V60-360-3  
FSN 4120-935-5417**

This copy is a reprint which includes current  
pages from Changes 1 and 2.



HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, DC, 15 March 1969

CHANGE }

No. 2 }

**Operator, Organizational, Direct Support  
General Support and Depot Maintenance Manual  
AIR CONDITIONER: COMPACT VERTICAL, 208 V,  
3 PHASE, 60,000 BTUH COOLING; 49,000 BTUH HEATING  
(TRANE MODELS) 50/60 CYCLE-MODEL MAC6V60-360-2,  
NSN 4120-00-935-5416, 400 CYCLE-MODEL MAC4V60-360-3  
NSN 4120-00-935-5417**

TM 5-4120-270-15, 1 April 1969, is changed as follows:

Title is changed as shown above.

Page 2 of cover. Add the following warning to the list of safety precautions:

**WARNING**

The burning of polyurethane foams is dangerous. Due to the chemical composition of polyurethane foam, toxic fumes are released when it is burned or heated. If it is burned or heated indoors, such as during a welding operation in its proximity, precautions should be taken to adequately ventilate the area. An exhaust system equivalent to that of a paint spray booth should be used. Air supplied respirators, approved by the National Institute for Occupational Safety and Health or the US Bureau of Mines, should be used for all welding in confined spaces and when ventilation is inadequate. Individuals who have chronic or recurrent respiratory conditions, including allergies and asthma, should not be employed in this type of environment.

Official:

*Chief of Staff*

VERNEL BOWERS

*Major General, United States Army*

*The Adjutant General*

Distribution:

To be distributed in accordance with DA Form 12-25C (qty rqr block no. 574), organizational maintenance requirements for Environmental Equipment, Air Conditioners, 60,000 BTU.

**Operator, Organizational, DS, GS, and Depot  
Maintenance Manual**

**AIR CONDITIONER: COMPACT VERTICAL,  
208 V, 3 PHASE, 60,000 BTUH COOLING:  
49,000 BTUH HEATING  
(TRANE MODELS)  
50/60 HERTZ — MODEL MAC6V60-360-2  
FSN 4120-935-5416  
400 HERTZ — MODEL MAC4V60-360-3  
FSN 4120-935-5417**

TM 5-4120-270-15, 1 April 1969, is changed as follows:

The title is changed to read as shown above. Through-

out the manual, change the word "cycle" to "hertz".

Page B-1. Appendix B is superseded as follows:

**APPENDIX B  
BASIC ISSUE ITEM LIST AND ITEMS  
TROOP INSTALLED OR AUTHORIZED**

**Section I. INTRODUCTION**

**B-1. Scope**

This appendix lists basic issue items, items troop installed or authorized which accompany the air conditioner and are required by the crew/operator for operation, installation, or operator's maintenance.

**B-2. General**

This basic issue items, items troop installed or authorized list is divided into the following sections:

a. *Basic Issue Items List*—Section II. Not applicable.

b. *Items Troop Installed or Authorized List*—Section III. A list in alphabetical sequence of items which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

**B-3. Explanation of Columns**

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section

II, and Items Troop Installed or Authorized, Section III.

a. *Source, Maintenance, and Recoverability Code(s) (SMR)*: Not applicable.

b. *Federal Stock Number*. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. *Description*. This column indicates the Federal item name and any additional description of the item required.

d. *Unit of Measure (U/M)*. A 2 character alphanumeric abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. *Quantity Authorized (Items Troop Installed Only)*. This column indicates the quantity of the item authorized to be used with the equipment.

# Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) Federal stock number	(3) Description  Ref. No. & Mfr code	(4) Unit of meas  Usable on code	(5) Qty auth
	7520-559-9618 5935-839-9681 4130-402-5417	CASE, MAINTENANCE AND OPERATIONAL MANUAL CONNECTOR, PLUG PLATE, BLOCKOFF	EA EA EA	1 1 1

y Order of the Secretary of the Army:

fficial:

**VERNE L. BOWERS**

*Major General, United States Army*

*The Adjutant General*

**CREIGHTON W. ABRAMS**

*General, United States Army*

*Chief of Staff*

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To be distributed in accordance with DA Form 12-25C (qty rqr block No. 574), Organizational maintenance requirements for Air  
conditioners: 60,000 BTU.

## OPERATOR, ORGANIZATIONAL, DS, GS, AND DEPOT

## MAINTENANCE MANUAL

## AIR CONDITIONER: COMPACT VERTICAL 208V, 3 PHASE

## 60,000 BTUH COOLING: 49,000 BTUH HEATING

## (TRANE MODELS)

## 50/60 CYCLE—MODEL MAC6V60-360-2

FSN 4120-935-5416

## 400 CYCLE—MODEL MAC4V60-360-3

FSN 4120-935-5417

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## CHAPTER 1 INTRODUCTION

### Section I. GENERAL

#### 1-1. Scope

a. This manual is published for use of personnel to whom Military Models MAC4V60-360-3 and MAC6V60-360-2 air conditioners are issued. Chapters 1 through 3 provide information on operation, preventive maintenance services, and organizational maintenance of the equipment, accessories, components, and attachments. Chapters 4 through 6 provide instructions for direct and general support and depot maintenance. Also included are description of main units and their relationship to other components.

b. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

c. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be

submitted on DA Form 2028 (Recommendations for Changes to DA Publications) and forwarded direct to the Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

d. Report all equipment improvement recommendations as prescribed by TM 38-750.

#### 1-2. Record and Report Forms

a. DA Form 2258 (Depreservation Guide for Engineer Equipment).

b. For other record and report forms applicable to the operator and organizational maintenance, refer to TM 38-750.

*Notes.* Applicable forms, excluding Standard Form 298 (United States Government Motor Vehicles Operator's Identification Card) which is carried by the operator, will be kept in a canvas bag mounted on the equipment.

### Section II. DESCRIPTION AND TABULATED DATA

#### 1-3. Description

a. *General.* The air conditioner (fig. 1-1 through 1-3) is used primarily in van type enclosures for providing filtered, conditioned, or heated air as required to maintain service conditions necessary for the efficient operation of electronic equipment and for the comfort of operating personnel housed within the specified vans. It is a completely self-contained, air cooled, electric motor driven unit designed for continuous operation with varying loads. It is equipped with internal ducting to the low side of the evaporator fans so that ventilation air from the Chemical, Biological, and Radiological (CBR) filter unit may be supplied by the evaporator fans.

b. *Condensing Section.* The condensing section, located at the bottom of the unit, contains the hermetically sealed compressor, condensing coil, receiver, condenser air intake opening, condenser

air discharge opening, control panel, junction box, condenser fan, fan motor, dehydrator, system access valves, solenoid valve, expansion valve, check valve and pressure release safety valve.

c. *Evaporator Section.* The evaporator section, located in the top of the unit, contains an evaporator coil, evaporator fans, air conditioning filters, intake and discharge grilles, evaporator condensation pan, expansion valve, solenoid valve, bypass pressure regulating valve, electrical heaters, sight glass, accumulators and a damper to regulate the amount of outdoor air entering the air conditioner.

#### 1-4. Identification and Tabulated Data

a. *Identification.* The air conditioner has major identification plates. The information contained on the plates is listed below. See figures 1-1 through 1-4 for location.

DISCHARGE GRILLE

CASING

INTAKE GRILLE  
LOUVER CONTROL

INTAKE GRILLE

FRONT ACCESS  
PANEL

CONTROL PANEL

CIRCUIT BREAKER  
ACCESS COVER

POWER RECEPTACLE  
CONNECTOR

**SHIPPING DIMENSIONS**

**LENGTH** 23-1/4 INCHES

**WIDTH** 34 INCHES

**HEIGHT** 65 INCHES

**WEIGHT:**

**MAC4V60-**

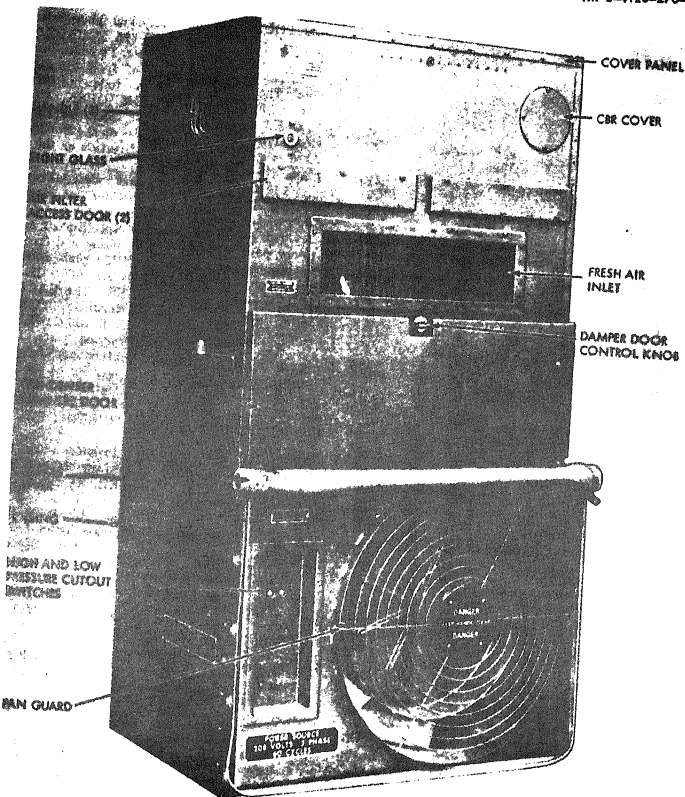
**360-3 615 POUNDS**

**MAC6V60-**

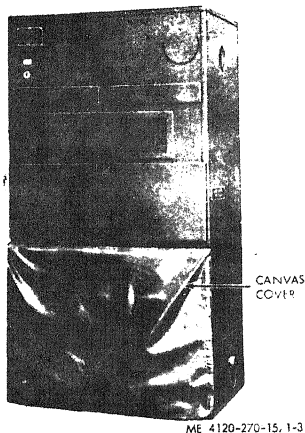
**360-2 620 POUNDS**

ME 4120-270-15/1-1

*Figure 1-1. Air Conditioner, left front 3/4 view with shipping dimensions.*



Figures 1-2. Air Conditioner, right rack 3/1 view.



ME 4120-270-15, 1-3

Figure 1-5. Air Conditioner, cover installed.

(1) *Military identification plate.* The plate on the MAC6V60-360-2 air conditioner contains the following information.

AIR CONDITIONER, VERTICAL COMPACT 60,000  
BTU/HR, 208 VOLT, 3 PHASE, 60 CYCLE  
FSN 4120-935-5416

PART NO. (97403) 13214E4300

MFD BY THE TRANE CO.

CONTRACT NO. DA-23-195-AMC-01159(T)

DATE

SERIAL NO.

WT — 620 lb

The MAC4V60-360-3 plate contains the same information but with the following changes: 400 CYCLE, FSN 4120-935-5417, PART NO. (97403) 13124E4200, WT — 615 LB.

(2) *Sight glass color change plate.* Three color bands are provided: green (Dry), chartreuse (Caution) and yellow (Wet), for use in conjunction with the sight glass to determine moisture content of refrigerant.

(3) *Refrigerant type and charge plate.* Specifies type and amount of refrigerant used to charge unit as follows: This unit charged with 26.9 lbs. Refrigerant-22.

(4) *Weight plate.* Specifies air conditioner weight in pounds. The MAC6V60 plate contains

620 POUNDS." The MAC4V60 plate information is: "GROSS WEIGHT 615 POUNDS."

(5) *Damper control plate.* Provides instructions for correct operation of fresh air damper door. The plates contain the following instructions: "FRESH AIR DOOR, OPEN, TURN, CLOSE." The open arrow is clockwise and the close arrow is counterclockwise on the front plate. Arrows are in the opposite direction on the rear plate.

(6) *Cutout switch reset plate.* Provides "PUSH TO RESET" instructions for resetting high and low pressure cutout switches.

(7) *Power supply plate.* Specifies air conditioner power supply voltage, phase and frequency requirements. The MAC6V60 plate contains the following wording: "POWER SOURCE 208 VOLTS 3 PHASE 60 CYCLES". The MAC4V60 plate has the following wording: "POWER SOURCE 208 VOLTS 3 PHASE 400 CYCLES".

(8) *Control panel instruction plate.* Indicates air conditioner temperature and function control settings for cooling, heating or ventilating modes of operation. See figure 2-1.

(9) *Circuit breaker access plate.* Located on lower front cover, identifies "CIRCUIT BREAKER ACCESS" opening.

(10) *Fan warning plate.* Provides warning to prevent possible personnel injury through carelessness as follows: "DANGER, KEEP HANDS CLEAR, DANGER".

(11) *Wiring diagram plate.* Illustrates complete air conditioner wiring. See figure 1-6.

(12) *Evaporator fan motor plate.* Specifies motor horsepower, type, serial number, speed, frame number, and electrical characteristics.

(13) *Condenser fan motor plate.* Specifies motor horsepower, type, serial number, speed, frame number, and electrical characteristics.

(14) *Compressor identification plate.* Specifies compressor model number, part number, serial number, refrigerant, contract number, and electrical characteristics.

#### b. Tabulated Data.

(1) *Air conditioner, compact, vertical, self-contained.*

Manufacturer .....	The Trane Company
Models .....	MAC4V60-360-3 and MAC6V60-360-2

Capacity:

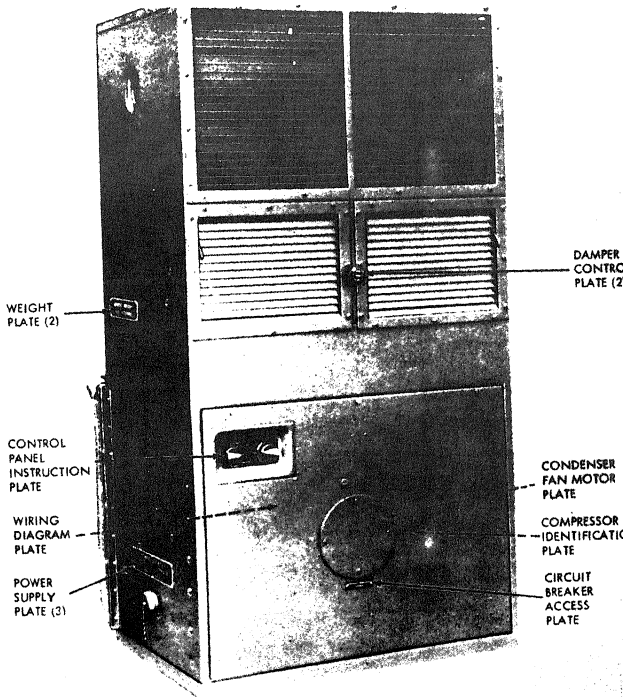
Cooling .....	60,000 BTU/HR
---------------	---------------

MAC6V60-360-2
---------------

operating on 50 cycles ..	50,000 BTU/HR
---------------------------	---------------

Heating
---------

60 Cycles .....	49,000 BTU/HR
-----------------	---------------



NOTE: REMOVE FRONT PANEL TO GAIN ACCESS TO WIRING DIAGRAM PLATE, CONDENSER FAN MOTOR PLATE AND COMPRESSOR IDENTIFICATION PLATE.

ME 4120-270-15/1

Figure 1-4 (1). Identification plates.

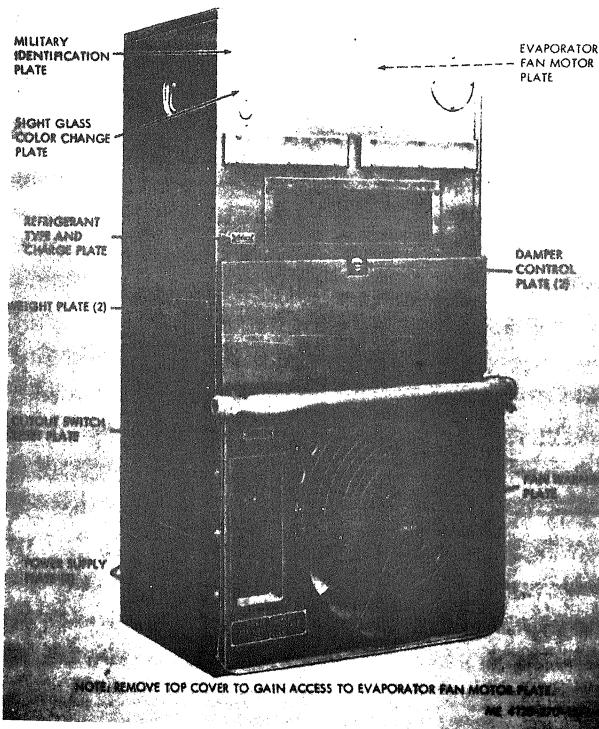


Figure 1-4 (8) — Continued.

100 Cycles.....52,000 BTU/HR

50 Cycles.....46,750 BTU/HR

Ventilating.....2,000 CFM

(2) *Condensing section.*

(a) *Compressor.*

Manufacturer.....The Trane Company  
Model.....MJ-6  
Type.....Hermetically sealed,  
reciprocating

Part number:  
MAC4V60-360-3.....A4525-760-4  
MAC6V60-360-2.....A4525-760-3

(b) *Condensing coil.*

Manufacturer.....The Trane Company  
Type.....Finned tube  
Part number.....A4525-702

(c) *Condenser fan.*

Manufacturer.....The Trane Company  
Type.....Axial, vane  
Part number.....B604-1008

(d) *Condenser fan motor.*

Manufacturer.....Welco Industries, Inc.  
Type.....Induction, direct drive  
Part number:  
MAC4V60-360-3.....7045-3  
MAC6V60-360-2.....7030-6

(e) *Dehydrator.*

Manufacturer.....Sporlan Valve Co.  
Type.....Dessicant drier  
Part number.....C164

(f) *Pressure relief valve.*

Manufacturer.....Superior Valve &  
Fitting Co.  
Type.....Preset, non-adjustable  
Part number.....3001-X4

(g) *Solenoid valves.*

Manufacturer.....Jacques-Evans Mfg. Co.  
Type.....Pilot operated, normally  
open  
Part number.....OB241  
Number per unit.....2

(h) *High pressure cutout switch.*

Manufacturer.....Penn Controls, Inc.  
Type.....Pressure operated,  
normally open  
Part number.....210AP40AN

(i) *Low pressure cutout switch.*

Manufacturer.....Penn Controls, Inc.  
Type.....Pressure operated,  
normally closed  
Part number.....210AP10AN

(j) *System access valves.*

Manufacturer.....Superior Valve & Fitting  
Co.  
Type.....Packless charging valves  
Part number.....5939X4  
Number per unit.....2

(3) *Evaporator section.*

(a) *Evaporator coil.*

Manufacturer.....The Trane Company  
Type.....Finned tube  
Part number.....E4525-835

(b) *Evaporator fans.*

Manufacturer.....The Trane Company

Type.....Centrifugal flow, air

Part number.....FAN 319 (LH) and

FAN 320 (RH)

Number per unit.....2

(c) *Evaporator fan motor.*

Manufacturer.....Welco Industries, Inc.  
Type.....Induction, direct drive  
double extended sh

Part number:  
MAC4V60-360-3.....4720-24  
MAC6V60-360-2.....4725-18

(d) *Air filters.*

Manufacturer.....Air-Maze Corp.  
Type.....Permanent  
Part number.....124935-065  
Number per unit.....2

(e) *Expansion valves.*

Manufacturer.....Alco Control Corp.  
Type.....Thermal expansion  
Cooling load.....4 1/2 ton.....2.1 ton  
Part number.....TCL400HW100.....DT12104  
Number per unit.....1.....1

(f) *Back pressure regulating valve.*

Manufacturer.....Controls Co. of Amer  
Type.....Pressure operated,  
normally closed  
Part number.....237A VIL-70327-142

(g) *Electric heaters.*

Manufacturer.....McGraw Edison  
Type.....Tubular  
Part number.....4496-011-01  
Number per unit.....6

(h) *Sight glass.*

Manufacturer.....Sporlan Valve Co.  
Type.....Bulls-eye  
Part number.....SA-K16 SEE ALL

(4) *Electrical Controls.*

(a) *Temperature control thermostat.*

Manufacturer.....Penn Controls, Inc.  
Type.....Bimetallic element,  
normally closed  
Part number.....A19AGF-15

(b) *Selector switch.*

Manufacturer.....Cutler-Hammer, Inc.  
Type.....Rotary, five-position  
Part number.....3912K216

(c) *Heater high temperature cutoff.*

Manufacturer.....Metals and Controls,  
Type.....Automatic reset, nor  
closed  
Part number.....CWA1249

(d) *Magnetic contactors.*

Manufacturer.....Cutler-Hammer, Inc.  
Type.....Three-pole, single th  
Load capacity.....50 amperes.....25 am  
Part number.....9565H94.....9565H  
Number per unit.....2.....3

(e) *Time delay relay.*

Manufacturer.....Dialtron Corp.  
Type.....Thermal delay, norm  
open  
Part number.....FR-30S-NO-24

(f) *Circuit breaker, MAC4V60-360-3.*  
 Manufacturer.....Heinemann Electric Co.  
 Type.....Manual reset  
 Part number.....71-212-7MG6

*Circuit breaker, MAC6V60-360-2.*  
 Manufacturer.....Heinemann Electric Co.  
 Type.....Manual reset  
 Part number.....71-212-6MG6

(g) *Fuses.*  
 Manufacturer.....Bussman Mfg. Co.  
 Type.....Cartridge  
 Load capacity.....5 amperes.....1.6 amperes  
 Part number.....KAW5.....FNM1-6/10  
 Number per unit.....1.....2

(h) *Transformer.*  
 Manufacturer.....Reid Hill Electronics  
 Type.....Stepdown, single phase  
 Part number  
     MAC4V60-360-3.....35666  
     MAC6V60-360-2.....35566

(i) *Terminal boards.*  
 Manufacturer.....Kulka Electric Corp.  
 Part number  
     10-terminal.....22010  
     6-terminal.....605-JJ-2502-6

(j) *Rectifier.*  
 Manufacturer.....Syntron Co.  
 Type.....Silicon semiconductor  
     bridge  
 Part number.....SS-0257

(k) *RFI Filters.*  
 Manufacturer.....Sprague Electric Co.  
 Part number.....5JX100  
 Number per unit.....4

(5) *Dimensions and weight (fig. 1-1).*

Height.....23 1/4 inches  
 Length.....34 inches  
 Width.....65 inches  
 Weight

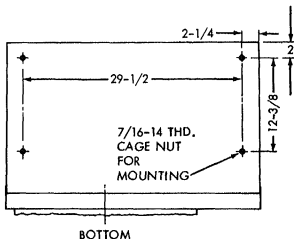
    MAC4V60-360-3.....615 pounds  
     MAC6V60-360-2.....620 pounds

(6) *Base plan. Refer to figure 1-5 for base plan.*

(7) *Wiring diagram. Refer to figure 1-6 for wiring diagrams.*

1-5. *Difference in Models*

This manual covers the Trane MAC4V60-360-3 and MAC6V60-360-2 air conditioners. The differences between the two air conditioners are in the electrical system. Model MAC4V60-360-3 is designed to operate from a 400 cycle, 208 volt, 3 phase supply. Model MAC6V60-360-2 is designed to operate from a 50/60 cycle, 208 volt, 3 phase supply. Where differences exist, each model is covered separately in applicable maintenance section of this manual.



ME 4120-270-15/1-5

Figure 1-5. Base plan.







## CHAPTER 2

# INSTALLATION AND OPERATION INSTRUCTIONS

### Section I. SERVICE UPON RECEIPT OF EQUIPMENT

#### 2-1. Unloading the Equipment

a. Remove any blocking or tie-downs that may have been used to secure the item to carrier. The air conditioner is shipped in a wooden carton, the base of which is raised to provide for insertion of tongs of a fork.

b. Use a forklift or other suitable lifting device to remove unit from carrier.

**Caution:** Use care in handling to avoid damaging the air conditioner.

#### 2-2. Unpacking the Equipment

a. *General.* Move air conditioner to installation site before removing shipping container. Cut the metal bands and remove top, end, and sides of carton, and the Kimpak covering. Remove bolts securing base of unit to crate. Using a suitable hoist or crane and a spreader bar attached to the lifting handles, lift unit from crate.

b. *Depreservation.* Prior to placing unit in operation, accomplish depreservation in accordance with instructions outlined in DA Form 2258 (Depreservation Guide of Engineer Equipment). DA Form 2258 is attached on or near the operational controls.

#### 2-3. Inspecting and Servicing Equipment

a. Perform daily preventive maintenance services (para 3-6).

b. Perform quarterly preventive maintenance services (para 3-7).

c. Inspect entire air conditioner for signs of damage, paying particular attention to evaporator and condenser coils.

d. The air conditioner contains a full operating charge of refrigerant and compressor oil. No further service is required.

#### 2-4. Installation of Separately packed Components

a. *General.* The air conditioner is basically a self-contained unit, however, in certain installa-

tions it may become desirable to place the control panel in a remote location and utilize the remote control blockoff plate.

b. *Blockoff Plate.* The blockoff plate is provided for installation when the controls are removed for remote control operation. The blockoff plate provided must be used so that no one will enter the lower compartment. Refer to figure 2-1, and install the blockoff plate.

#### 2-5. Installation or Setting-up Instructions

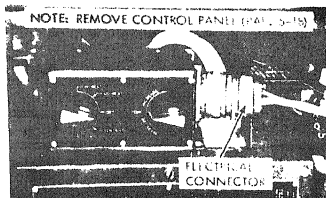
a. *General.* Set the air conditioner in a level position to allow proper condensate drainage (operation will be satisfactory with unit setting at a slight angle, and using one of the alternate drain connections).

b. *Locating the Unit.* The removable lower front panel and evaporator fan discharge and intake grilles must be accessible for normal service and maintenance. The condenser air intake and discharge openings must always be unobstructed to allow sufficient air for condensing purposes. Clearance must be allowed for the condenser inlet door which must be open during operation. The evaporator fan discharge and intake openings at front of unit should be relatively free from obstruction to permit maximum unit capacity. Sufficient headroom must be allowed for removal of the mist eliminator.

*Note.* Remove discharge and intake grilles and filter if unit is to be used with ducts carrying air to and from the conditioned space. Install grilles and filter in duct.

*Note.* Remove CBR cover (fig. 1-2) if a CBR filter is to be attached to the air conditioner.

c. *Installing Unit.* Bolt unit to floor or other flat surface. Refer to base plan (fig. 1-5) for dimensions. Connect drain hose to drain nipple at base of unit to lead condensate away from unit. Alternate 1/2 inch NPT condensate drain connections are provided at both sides and front and rear of unit. If one of these is used, remove the desired drain plug prior to installing the drain hose.



NOTE: REMOVE CONTROL PANEL (PART 5-15)

NOTE: CONNECT CONTROL PANEL AND BLOCKOFF RECEPTACLE WITH SUITABLE CABLE.

REMOVE COVER PLATE AND INSTALL ELECTRICAL CONNECTOR FROM REAR. SECURE WITH SCREWS (4).

MATCH TO HOLES ON JUNCTION BOX TOP PANEL AND INSTALL MOUNTING BOLT (4).

ME 4120-270-15, 2-1

Figure 2-1. Remote control connection installation.

## Section II. MOVEMENT TO NEW WORKSITE

### 2-6. Dismantling for Movement

#### a. General.

(1) Shut off electrical power supply to air conditioner and disconnect power cable from unit.

(2) Disconnect drain hose from unit.

#### d. Power Source.

(1) Model MAC4V60-360-3. Operates on 208 volts, 400 cycle, 3 phase power.

(2) Model MAC6V60-360-2. Operates on 208 volt, 50/60 cycle, 3 phase power.

(3) Power receptacle connector. An MS31-00R32-17P receptacle is located on the left hand side of unit, above the base drain plug. Connect the proper electrical power supply source to this receptacle using a MS3106R32-17S plug or acceptable alternate. Alternate electrical power connections are provided at both sides and rear of the unit; any location may be used by interchanging the power receptacle at rear of unit and one of the cover plates at side of unit. Be sure to attach cover plate over unused location at rear of unit to prevent air from being drawn through the opening.

#### e. Remote Control.

(1) General. The control panel may be removed from the unit and used as a remote control for operation of the air conditioner. The remote control connection and blockoff plate provided must be used when the control panel is used as a remote control.

#### (2) Remote control connection.

(a) Disconnect power source from unit.

(b) Refer to figure 2-1, and install the remote control connection.

using suitable lifting equipment attached to the recessed handles at sides of unit.

Note. Use a spreader bar whenever unit is hoisted with a crane.

c. Long Distance Movement. Crate the air conditioner, providing adequate protection to grilles and control panel. Provide suitable blocking and tie-downs to prevent unit from shifting during

**2-8. General**

This section describes, locates, illustrates, and furnishes the operator, crew or organizational maintenance personnel sufficient information about the various controls and instruments for proper operation of the air conditioner.

**2-9. Controls and Instruments**

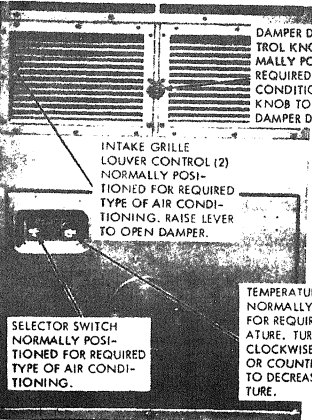
a. *General.* The controls and instruments on the air conditioner are illustrated on figure 2-2.

b. *High Pressure Cutout Control.* The high pressure cutout located at the rear of the unit (fig. 2-2) is designed to sense discharge line pressure at the compressor and will cutout at 445 psig (pounds per square inch gage). When dis-

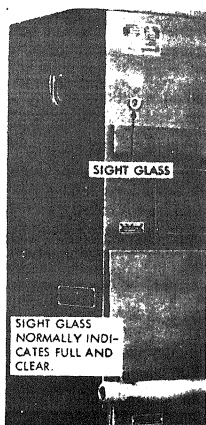
charge line pressure has reduced to 400 psig, the high pressure cutout control can be reset by pushing the reset button.

c. *Low Pressure Cutout Control.* The low pressure cutout located at the rear of the unit (fig. 2-2) is designed to sense suction line pressure at the compressor and will cutout at 7 psig. When suction line pressure has increased above this limit, the low pressure cutout control can be reset by pushing the reset button.

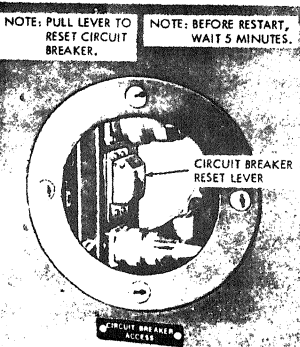
d. *Liquid Line Sight Glass.* The sight glass (fig. 2-2) indicates dryness of the system. Moisture in the refrigerant is shown by the indicator turning from green to yellow. A shortage of refrigerant is indicated by bubbles in the sight glass.



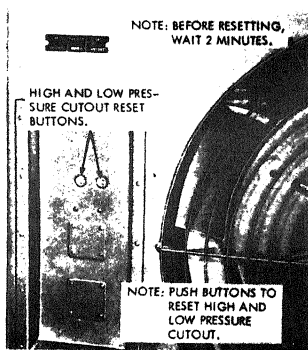
A



B



C



D

ME 4120-270-15/2-2

Figure 2-2. Controls and instruments.

## Section IV. OPERATION OF EQUIPMENT

### 2-10. General

a. The instructions in this section are published for the information and guidance of personnel responsible for operation of the air conditioner.

b. The operator must know how to perform every operation of which the air conditioner is

capable. This section gives instructions on starting, stopping, and operating details of the air conditioner. Since nearly every application presents a different problem, the operator may have to vary given procedure to fit the individual job. Operating control settings are listed in table 2-1.

Table 2-1. Operating Control Settings

Type of air conditioning required	Thermostat setting	Indoor return air damper	Outdoor air damper	Selector switch position
Cooling — 100% Recirculated Air	Desired Temperature	Open	Closed	COOL
Cooling — With Fresh Makeup Air	Desired Temperature	Partially* Closed	Open	COOL
Cooling — With Fresh Makeup Air Drawn Through CBR Filter (Outdoor Air Contaminated)	Desired Temperature	Open	Closed	COOL
Heating — 100% Recirculated Air	Desired Temperature	Open	Closed	LO-HEAT or HI-HEAT
Heating — With Fresh Makeup Air	Desired Temperature	Partially* Closed	Open	LO-HEAT or HI-HEAT
Heating — With Fresh Makeup Air Drawn Through CBR Filter (Outdoor Air Contaminated)	Desired Temperature	Open	Closed	LO-HEAT or HI-HEAT
Ventilation — Maximum Outdoor Air	Any	Closed	Open	VENTILATE

\* Partial closing of the indoor return air damper causes a greater portion of the total air flow to be drawn from the outside.

### 2-11. Starting

a. Perform daily preventive maintenance services (para 3-6).

b. Refer to figure 2-3, and start the air conditioner.

c. If the air conditioner fails to start, remove cover on lower front panel and reset the circuit breaker.

**Caution:** Wait 5 minutes before restarting the unit after operation.

d. Refer to table 2-1, and adjust air conditioner for desired mode of operation.

### 2-12. Stopping

Refer to figure 2-4, and stop the air conditioner.

### 2-13. Air Conditioner Operation

Refer to figure 2-5, for instructions on operation of the air conditioner.

### 2-14. Operation in Extreme Cold

a. **General.** The air conditioner is designed to

(Fahrenheit). Be sure that all thermostatic controls and dampers are in working order.

b. **Electrical System.** Make sure the electrical system is free of ice and moisture.

**Caution:** Do not disturb the wiring during cold weather unless absolutely necessary. Cold temperatures make wiring and insulation brittle and easily broken.

### 2-15. Operation in Extreme Heat

a. **General.** The air conditioner is designed to operate satisfactorily at temperatures up to 125°F.

b. **Ventilation.** Allow sufficient room around the air conditioner for adequate air circulation.

**Note.** Do not restrict the flow of air at the intake and discharge openings of the unit.

### 2-16. Operation in Dusty or Sandy Areas

Clean the condenser coil and evaporator coil weekly or more often if necessary. Clean the mist eliminator, air conditioning filters, fresh air

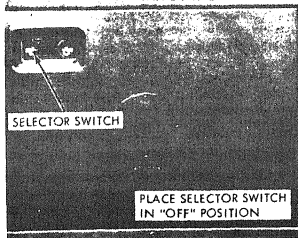
## 2-17. Operation Under Rainy or Humid Conditions

If the unit is outside and not operating, close dampers and air inlet door; cover condenser air discharge with tarpaulin provided. Protect air conditioner with the canvas cover provided. Remove covers during dry periods. Open access panels and covers to allow unit to dry before operating. Use caution when operating electrical equipment in damp or wet areas to avoid shock hazard.

## 2-18. Operation in Salt Water Areas

Wash the exterior of the unit with clean, fresh water at frequent intervals. Do not damage the electrical equipment during the cleaning operation. Coat exposed metal surfaces with rust proofing material. Remove corrosion and paint the exposed metal surface.

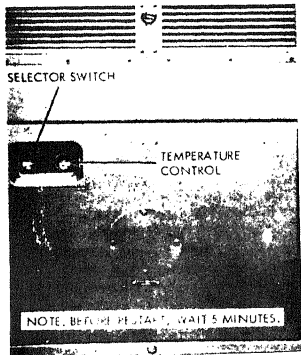
CAUTION: BEFORE RESTART,  
WAIT 5 MINUTES.



CAUTION: TO PREVENT REFRIGERANT FROM  
CONDENSING IN CRANKCASE  
AND MIXING WITH THE OIL, DO  
NOT DISCONNECT THE UNIT  
FROM POWER SOURCE DURING  
THE SHUTDOWN PERIOD.

ME 4120-270-15/2-4

Figure 2-4. Stopping instructions.

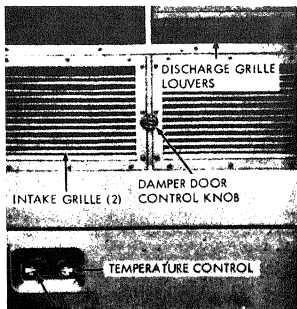


- STEP 1. POSITION TEMPERATURE CONTROL  
FOR DESIRED TEMPERATURE.
- STEP 2. PLACE SELECTOR SWITCH ON  
"COOL" POSITION FOR COOLING  
OPERATION, ON "LO HEAT" OR  
"HI HEAT" POSITIONS FOR HEAT-  
ING, OR ON "VENTILATE" FOR  
VENTILATING OPERATION.

ME 4120-270-15/2-3

Figure 2-3. Starting instructions.





SELECTOR SWITCH

NOTE: BEFORE RESTART, WAIT 5 MINUTES.

A. COOLING OPERATION.

- STEP 1. POSITION TEMPERATURE CONTROL FOR DESIRED TEMPERATURE.
- STEP 2. ADJUST DISCHARGE GRILLE LOUVERS FOR DESIRED CONDITIONED AIR DELIVERY PATTERN.
- STEP 3. ADJUST INTAKE GRILLES AND DAMPER DOOR AS INSTRUCTED IN TABLE 2-1.
- STEP 4. PLACE SELECTOR SWITCH ON "COOL" POSITION.

B. HEATING OPERATION.

- STEP 1. POSITION TEMPERATURE CONTROL FOR DESIRED TEMPERATURE.
- STEP 2. ADJUST DISCHARGE GRILLE LOUVERS FOR DESIRED CONDITIONED AIR DELIVERY PATTERN.
- STEP 3. ADJUST INTAKE GRILLES AND DAMPER DOOR AS INSTRUCTED IN TABLE 2-1.
- STEP 4. PLACE SELECTOR SWITCH ON "LO HEAT" OR "HI HEAT" AS REQUIRED.

C. VENTILATING OPERATION:

- STEP 1. ADJUST DISCHARGE GRILLE LOUVERS FOR DESIRED CONDITIONED AIR DELIVERY PATTERN.
- STEP 2. ADJUST INTAKE GRILLES AND DAMPER DOOR AS INSTRUCTED IN TABLE 2-1.
- STEP 3. PLACE SELECTOR SWITCH IN "VENTILATE" POSITION.

ME 4120-270-15/2-5

*Figure 2-5. Operating instructions.*



## CHAPTER 3

### OPERATOR AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

#### Section I. OPERATOR AND ORGANIZATIONAL MAINTENANCE

##### TOOLS AND EQUIPMENT

#### 3-1. Special Tools and Equipment

No special tools or equipment are required by the operator or organizational maintenance personnel for maintenance of the air conditioner.

#### 3-2. Basic Issue Tools and Equipment

Tools and repair parts issued with or authorized for the air conditioner are listed in the Basic Issue Items List, Appendix B of this manual.

#### Section II. LUBRICATION

#### 3-3. General Lubrication Information

The air conditioner fan motors and compressor are lubricated and sealed by the manufacturer. No additional lubrication is required.

#### 3-4. Detailed Lubrication Information

Although the air conditioner requires no lubrication maintenance, operation of grilles and damp-

ers will be assisted by periodically adding a few drops of light oil to all pivot points, bearing surfaces and linkages. During cold weather operation clean off all accumulated oil and dirt and use graphite for lubrication of the points outlined above.

#### Section III. PREVENTIVE MAINTENANCE SERVICES

#### 3-5. General

To insure that the air conditioner is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services to be performed are listed and described in paragraphs 3-6 and 3-7. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation, which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with corrective action taken, on DA Form 2404 (Equipment Inspection Maintenance Worksheet) at the earliest possible opportunity.

#### 3-6. Daily Preventive Maintenance Services

This paragraph contains an illustrated tabulated listing of the preventive maintenance services which must be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to figure 3-1 for daily preventive maintenance services.

#### 3-7. Quarterly Preventive Maintenance Services

a. This paragraph contains an illustrated tabulated listing of the preventive maintenance services which must be performed by organization maintenance personnel at quarterly intervals. The quarterly interval is equal to 3 calendar months or 250 hours of operation whichever occurs first.

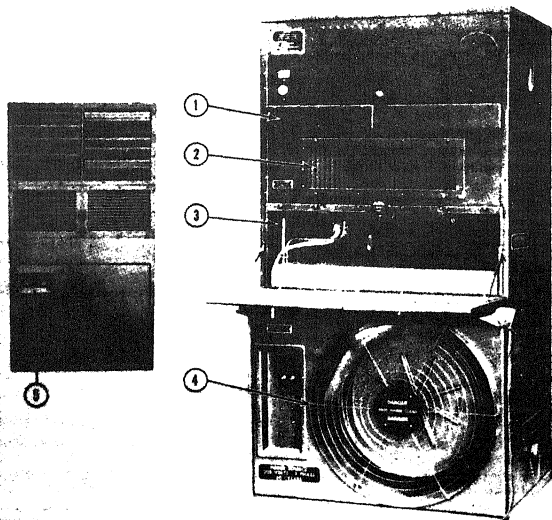
b. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to figure 3-2 for quarterly preventive maintenance services.

# PREVENTATIVE MAINTENANCE SERVICES DAILY

TM 5-4120-270-15

TRANE MODELS MAC4V60-360-3 & MAC4V60-360-4

AIR CONDITIONER



ITEM

PAR REF

1	<u>AIR FILTER.</u> Clean air conditioning filters.	3-9
2	<u>INTAKE SCREEN.</u> Clean fresh air intake screen. Tighten loose mounting.	
3	<u>INTAKE SCREEN.</u> Clean condenser intake screen. Tighten loose mounting.	
4	<u>FAN GUARD.</u> Clean condenser fan guard. Tighten loose mounting.	
5	<u>CONTROLS.</u> Check for damage and proper operation.	
NOTE: OPERATION. During operation observe any unusual noise or vibration.		

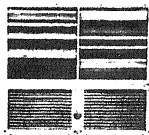
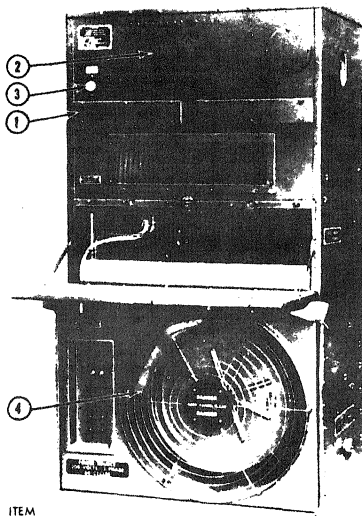
MEC 4120-270-15/3-1

# PREVENTATIVE MAINTENANCE SERVICES QUARTERLY

TM 5-4120-270-15

TRANE MODELS MAC4V60-360-3 & MAC6V60-360-2

AIR CONDITIONER



5

ITEM

PAR REF

1	<b>AIR FILTER.</b> Clear or replace filter.	3-9
2	<b>BLOWERS.</b> Clean blower. Check for loose mounting. Replace damaged blower.	3-28
3	<b>SIGHT GLASS.</b> Check for oil level. Check glass. Check for full cond. fluid in unit and absence of moisture in system.	5-22
4	<b>FAN.</b> Clean fan. Tighten mounting. Replace damaged fan.	3-26
5	<b>CONTROLS.</b> Check for damage and proper operation.	
<b>NOTE: OPERATION.</b> During operation observe any unusual noise or vibration.		

MEC 4120-270-15/3-2

### 3-8. General

The instructions in this section are published for the information and guidance of the operator to maintain the air conditioner.

**Warning:** Disconnect the air conditioner from the power source before performing any maintenance on the components of this unit.

### 3-9. Air Filter Service

*a. General.* The air filters are located under the evaporator blower assembly. They remove airborne particles of dust and other contaminants from the conditioned area.

*b. Removal.* Refer to figure 3-3 and remove filter access doors and filters.

*c. Servicing.* Refer to figure 3-3 and service both air filters.

*d. Installation.* Refer to figure 3-3 and install filters and access doors in reverse order of removal.

### 3-10. Mist Eliminator and Evaporator Coil Service

*a. General.* The mist eliminator, located between the air discharge grille and the evaporator coil, removes moisture from the air after the air has passed over the evaporator coil. The evaporator coil is to be cleaned each time the mist eliminator is serviced. The coil may be cleaned without removal from air conditioner.

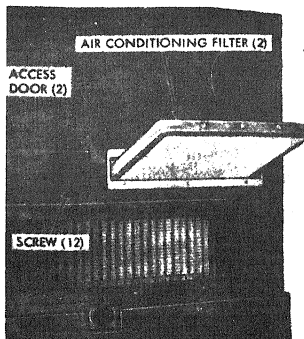
*b. Maintenance Procedure.* Refer to paragraph 3-25 and remove the evaporator air discharge grille and top cover panel. Refer to figure 3-4 and perform prescribed maintenance service.

*c. Installation.* Refer to figure 3-4 and install the mist eliminator. Install evaporator discharge grille and top cover panel (para 3-25).

### 3-11. Condenser Coil

*a. General.* The condenser coil may be cleaned without removal from the air conditioner.

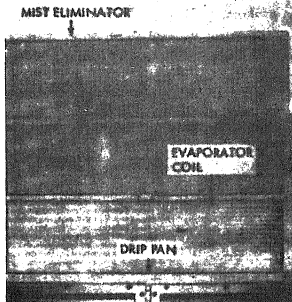
*b. Maintenance Procedure.* Refer to figure 3-5 and perform prescribed maintenance service.



- STEP 1. REMOVE SCREW (12) AND ACCESS DOOR (2).
- STEP 2. SLIDE AIR FILTER FROM GUIDE CHANNEL.
- STEP 3. WASH FILTERS IN APPROVED CLEANING SOLVENT AND DRY THOROUGHLY WITH COMPRESSED AIR.
- STEP 4. DIP OR SPRAY FILTERS WITH FILTERKOTE OR OIL CONFORMING TO MIL SPEC. 0-2104 GRADE 20, 30 OR BETTER. DRAIN OFF EXCESS OIL BEFORE INSTALLING FILTERS.

ME 4120-270-15/3-3

Figure 3-5. Servicing air conditioning filters.



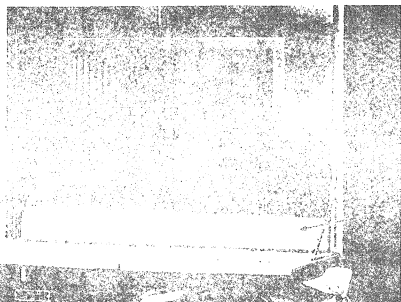
**WARNING: DO NOT USE STEAM TO CLEAN COIL.**

**NOTE: THE MIST ELIMINATOR MUST BE INSTALLED IN ACCORDANCE WITH THE STAMPED WORD "TOP" AND THE AIR FLOW ARROW.**

- STEP 1. SLIDE MIST ELIMINATOR UPWARD OUT OF GUIDES.
- STEP 2. WASH MIST ELIMINATOR IN AN APPROVED CLEANING SOLVENT AND DRY THOROUGHLY WITH COMPRESSED AIR.
- STEP 3. COAT MIST ELIMINATOR WITH FILTERKOTE OR OIL CONFORMING TO MIL SPEC. 0-2104, GRADE 20 OR 30, BY IMMERSION OR SPRAY. DRAIN OFF EXCESS BEFORE INSTALLATION.
- STEP 4. CLEAN OUT DRAIN PAN.
- STEP 5. CLEAN EVAPORATOR COIL SURFACE. BLOW DUST AND OTHER FOREIGN MATTER FROM BETWEEN FINS WITH COMPRESSED AIR. HOLD NOZZLE OF AIR HOSE AT LEAST 6 TO 8 INCHES FROM COIL TO AVOID DAMAGE TO FINS.

ME 4120-270-15/3-4

Figure 3-4. Servicing mist eliminator and evaporator coil.



NOTE: THE CONDENSER COIL IS CLEANED WITHOUT REMOVING THE COIL FROM THE AIR CONDITIONER.

WARNING: DO NOT USE STEAM TO CLEAN COILS.

#### TO SERVICE:

- STEP 1. REMOVE INTAKE SCREEN (PAR. 3-27).
- STEP 2. CLEAN THE COIL SURFACE AND BLOW DIRT FROM BETWEEN THE FINS WITH COMPRESSED AIR. HOLD NOZZLE OF AIR HOSE AT LEAST 6 TO 8 INCHES AWAY FROM COIL TO AVOID DAMAGE TO FINS.

ME 4120-270-15/3-5

Figure 3-5. Servicing condenser coil.

## Section V. TROUBLESHOOTING

### 3-12. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner and its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause. Any trouble beyond the scope of organizational maintenance shall be reported to direct support maintenance.

### 3-13. Compressor Fails to Start

Probable cause	Possible remedy
Power line failure	Restore power.
Selector switch improperly set	Set selector switch to "COOL"
Circuit breaker tripped	Reset circuit breaker.
High or low pressure cutout switches tripped	Push reset button to close switch.

#### Probable cause

Loose, broken or defective electrical leads

#### Possible remedy

Tighten loose connections. Repair leads as necessary.

### 3-14. Compressor Starts Normally, but Stops on Overload

#### Probable cause

Obstructed intake or exhaust air grilles

High head pressure

Defective condenser fan motor

#### Possible remedy

Clean out grilles and remove obstacles to air circulation

Clean condenser coil (para 3-11). Check condenser fan for damage or looseness. Replace if defective (para 3-29).

Replace condenser fan motor (para 3-36).

### 3-15. Reduced Cooling Capacity

#### Probable cause

Dirty or clogged air filters

#### Possible remedy

Clean or replace air filters



Improperly adjusted (closed) evaporator return and discharge air grilles or fresh air and CBR air intakes	Adjust louvers and dampers correctly (table 2-1).
Dirty or clogged condenser coil	Clean condenser coil (para 3-11).
Improperly set thermostat (too high)	Set thermostat to desired ambient temperature.
Damaged or loose evaporator fans	Check evaporator fans for damage or looseness. Replace if defective. (para 3-28).
Defective fan motor	Replace evaporator fan motor (para 3-36).

Probable cause	Possible remedy
Improperly adjusted (closed) evaporator return and discharge air grilles or fresh air and CBR air intakes	Adjust louvers and dampers correctly (table 2-1).
Dirty or clogged air filters	Clean or replace air filter (para 3-9).
Loose connections or defective leads in the heater circuit	Tighten loose connections. Repair leads as necessary.

### 3-16. No Heat in "Heat" Position

Probable cause	Possible remedy
Power line failure	Restore power.
Loose connections or defective wiring in heater or fan circuits	Tighten loose connections. Repair damaged wiring.
Inoperative evaporator fan motor	Replace evaporator fan motor (para 3-36).

### 3-18. Inoperative Compressor Crankcase Heater

Probable cause	Possible remedy
Air conditioning disconnected from power line	Stop unit by turning selector switch to "OFF", leave connected to power line.

## Section VI. RADIO INTERFERENCE SUPPRESSION

### 3-19. Definitions

*a. Interference.* The term interference as used herein applies to electrical disturbances in the radio frequency range which are generated by the air conditioner and which may interfere with the proper operation of radio receivers or other electronic equipment, or enable the enemy to locate the equipment.

*b. Interference suppression.* The term "interference suppression" as used herein applies to the methods used to eliminate or effectively reduce radio interference generated by the air conditioner.

### 3-20. General Methods Used to Attain Proper Suppression

*a.* Essentially, suppression is attained by providing a low resistance path to ground for stray currents. Methods used include shielding the ignition and high frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

*b.* In the air conditioner, filters are used to ground RFI-producing stray currents in the electrical system. All magnetic contactors and switches are effectively shielded in metal boxes which are bonded to each other and to the frame with grounding straps. The air conditioner frame

is grounded through the junction box to the power line ground wire.

### 3-21. Interference Suppression Components

*a. Primary Suppression Components.* The primary suppression components are those whose primary function is to suppress radio frequency interference. These components are described and located in figure 3-6.

*b. Secondary Suppression Components.* These components have radio frequency interference suppression functions which are incidental or secondary to their primary function and are located in figure 3-6.

### 3-22. Replacement of Suppression Components

Refer to figure 3-7 and replace radio frequency interference suppression components.

### 3-23. Testing of Radio Interference Suppression Components

Test the filters using a continuity tester; replace defective filters. If the test equipment is not available and interference is indicated, isolate cause by the trial-and-error method of replacing each filter in turn until the cause of interference is located and eliminated.

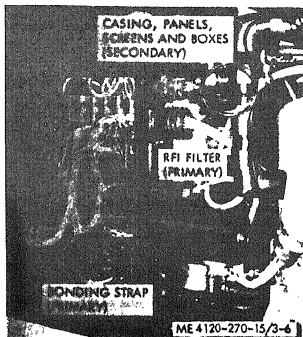


Figure 3-6. Interference suppression components.

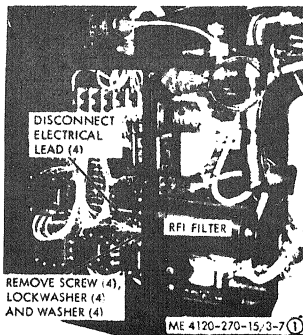
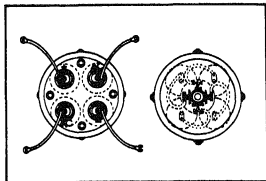
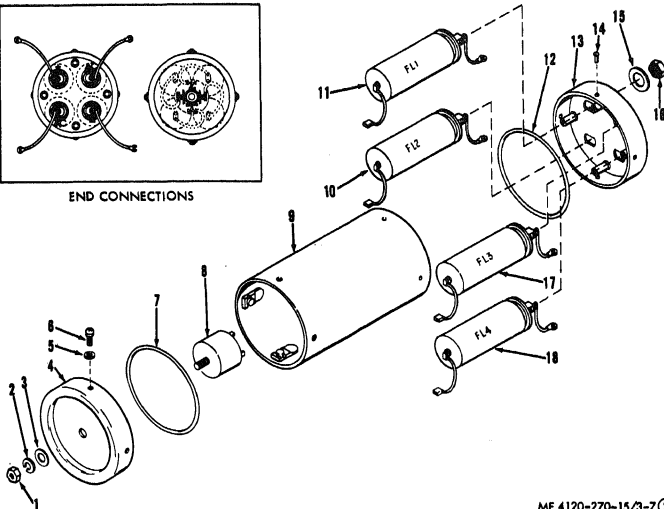


Figure 3-7. (1). Interference suppression components removal and replacement.



END CONNECTIONS



ME 4120-270-15/3-7 (2)

Key to fig. 3-7 (2):

- 1 Nut, hex, 1/4-20
- 2 Washer, lock, 1/4 in.
- 3 Washer, flat, 1/4 in.
- 4 End cap, top

- 5 Washer, flat, 3/8 in.
- 6 Screw, slotted head, No. 6-32 x 3/8
- 7 Gasket, RFI
- 8 Rectifier

- 9 Tube
- 10 FRI filter Assy.
- 11 RFI filter Assy.
- 12 Gasket, RFI
- 13 End cap, bottom

- 14 Rivet, blind
- 15 Washer, flat, 7/16 in.
- 16 Nut, hex, 7/16 20NF-2A
- 17 RFI filter Assy.
- 18 RFI filter Assy.

Figure 3-7 (2). Interference suppression components, exploded view.

## Section VII. GRILLS, COVERS, SCREENS, INLET DOOR, FAN GUARD, LOWER FRONT PANEL, FRESH AIR DAMPER DOOR CONTROL, IDENTIFICATION PLATES AND BASE DRAIN

### 3-24. General

The air conditioner is constructed with removable aluminum panels. The front access panel provides access to the control panel, junction box, compressor and associated components. A discharge grille protects the evaporator coil and controls the discharge of conditioned air. The intake grille protects the air filters and regulates the amount of air returned to the unit. The condenser coil inlet door, grille and screen protect

the condenser coil. A fan guard protects the condenser fan. A fresh air inlet screen permits the entry of outside air; amount is regulated by a damper operated by a knob and linkage. An intake cover provides for attachment of a CF filter unit.

**Warning:** Disconnect air conditioner from power source before performing any maintenance on the components of the unit.

### **3-25. Cover Panel, Discharge Grille, Intake Grilles, and Front Access Panel**

*a. Removal.* Refer to figure 3-8, and remove the cover panel, discharge grille, intake grilles and front access panel.

*b. Installation.* Install the cover panel, discharge grille, intake grilles and front access panel in reverse order of removal as illustrated in figure 3-8.

### **3-26. Air Conditioning Filters**

*a. Removal.* Refer to figure 3-9 and remove the air conditioning filters.

*b. Installation.* Clean or replace air filters. Refer to figure 3-9 and install the air conditioning filters in reverse order of removal.

### **3-27. Fresh Air Inlet Screen, CBR Cover, Fan Guard, and Condenser Coil Inlet Door and Screen**

*a. Removal.* Refer to figure 3-10, and remove the fresh air inlet screen, CBR cover, fan guard, and condenser coil inlet door and screen.

*b. Installation.* Install the fresh air inlet screen, CBR cover, fan guard, and condenser coil inlet door and screen in reverse order of removal as illustrated in figure 3-10.

### **3-28. Evaporator Fans and Inlet Rings**

*a. General.* The MAC4V60-860-3 and MAC-6V60-860-2 air conditioners are provided with centrifugal air foil evaporation fans to reduce excessive vibration and noise.

*b. Removal.* Refer to figure 3-11 and remove the inlet rings and evaporator fans.

*c. Installation.* Install the inlet rings and evaporator fans in reverse order of removal as illustrated on figure 3-11.

### **3-29. Condenser Fan**

*a. General.* The axial flow condenser fan and baffle, figure 3-12, reduce excessive vibration and noise.

*b. Removal.* Refer to figure 3-12, and remove the condenser fan.

*c. Installation.* Install the condenser fan in reverse order of removal as illustrated on figure 3-12.

### **3-30. Fresh Air Damper Door Control**

*a.* The damper door control consists of a worm gear and linkage arrangement by which the damper door can be placed in any position between full open and closed.

*b. Removal.*

(1) Loosen setscrews and remove screws from center of adjusting knobs. Remove knobs (fig. 3-13).

(2) Remove evaporator air intake grilles (para 3-25).

(3) Remove short linkage rod and gear lever assembly from housing. Remove long linkage rod and worm assembly.

(4) Remove worm and gear if required for replacement.

*c. Installation.* Install replacement parts by reversing order of disassembly (fig. 3-13). Check damper control OPEN and CLOSED positions. Adjust length of short linkage rod (15, fig. 3-13) between ball joints as required for proper operation.

### **3-31. Identification Plates**

*a. General.* Identification plates provide information for operation of the air conditioner. (fig. 1-4).

*b. Removal.* Carefully file rivets attaching identification plates to casing and remove plates.

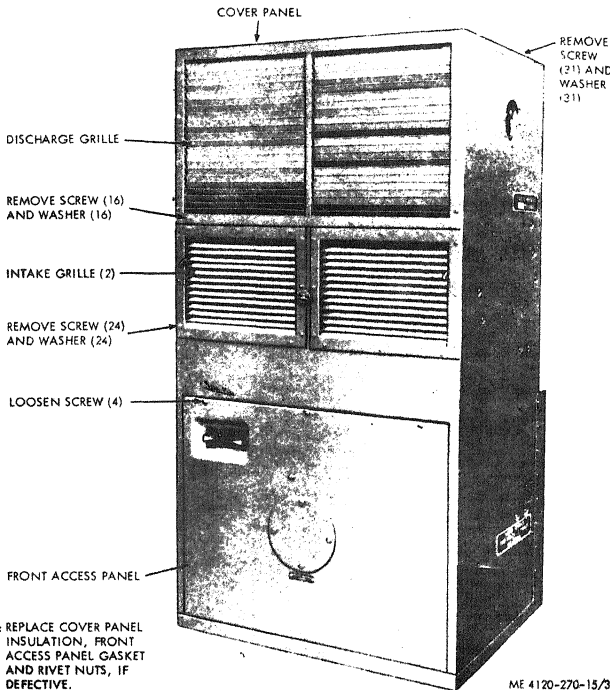
*c. Installation.* Set new rivets to attach new plate securely. Use care to avoid damaging external panels.

### **3-32. Base Drain**

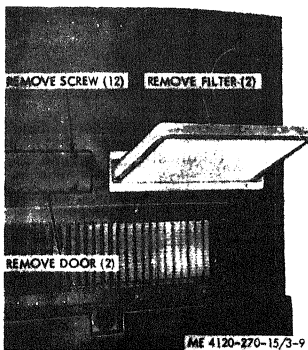
*a. General.* Moisture condensate from the evaporator is collected in the drain pan and conveyed to a sump in the air conditioner base by means of tubing. The sump drains through attached drain hose.

*b. Removal.* Remove lower front access panel (para 3-25). Flush out base sump with clear water and inspect and clean drain hose as required.

*c. Installation.* Install lower front access panel and assemble drain hose by reversing order of removal.



*Figure 3-8. Cover panel, discharge grille, intake grille and front access panel, removal and installation.*



*Figure 3-9. Air conditioning filters, removal and installation.*

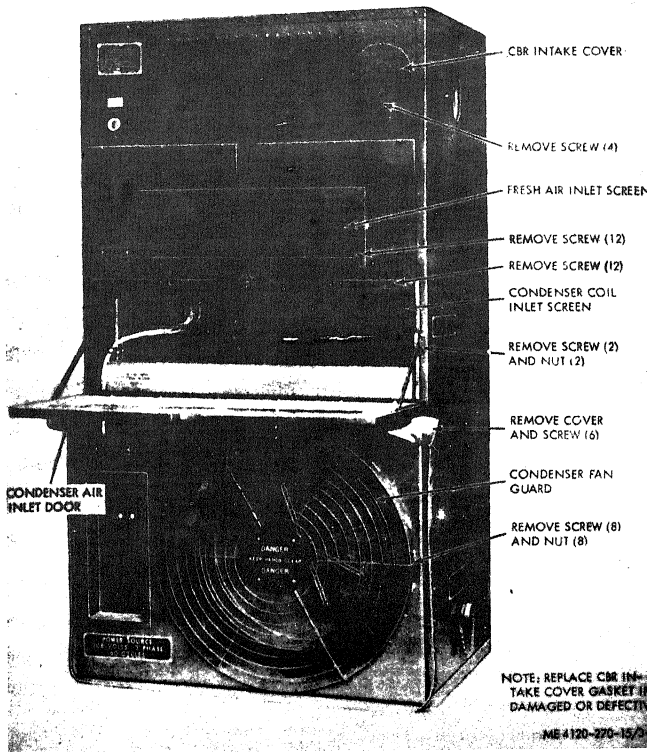
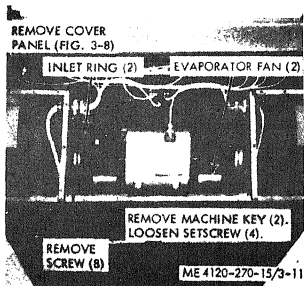
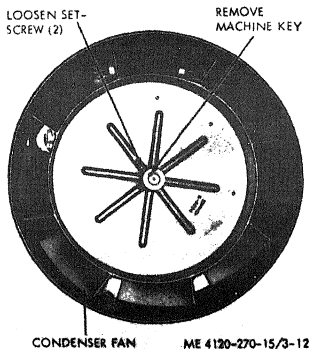


Figure 3-10. Fresh air inlet screen, CBR cover, fan guard, and condenser coil inlet door and screen, removal and installation.

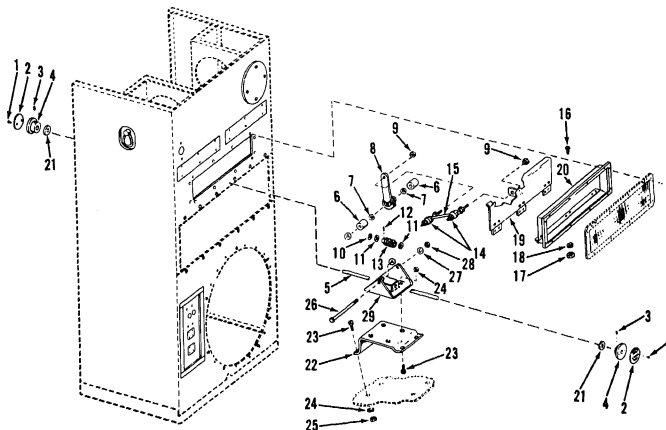


*Figure 3-11. Evaporator fans and inlet rings, removal and installation.*



*Figure 3-12. Condenser fan, removal and installation.*





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**Key to fig. 3-18:**

- |   |                              |                                     |                                  |
|---|------------------------------|-------------------------------------|----------------------------------|
| 1 Screw, drive                          | 9 Nut, self-locking, #10-32  | 17 Nut, self-locking, #8-32         | 26 Screw, hex hd, 1/4-28 x 8 in. |
| 2 Plate, instruction                    | 10 Washer, spring, 5/8 in.   | 18 Washer, flat                     | 27 Washer, flat, 1/4 in.         |
| 3 Screw, set, hex skt, #10-32 x 3/8 in. | 11 Washer, flat              | 19 Damper assembly                  | 28 Nut, self-locking, 1/4-28     |
| 4 Knob                                  | 12 Pin, locking              | 20 Box assembly                     | 29 Bracket, support              |
| 5 Rod, linkage, long                    | 13 Worm gear                 | 21 Grommet                          |                                  |
| 6 Spacer, 5/8 in.                       | 14 Joint, ball               | 22 Bracket, support                 |                                  |
| 7 Washer, spring, 5/8 in.               | 15 Rod, linkage, short       | 23 Screw, machine, #10-32 x 3/4 in. |                                  |
| 8 Worm gear assembly                    | 16 Screw, rd hd, #8-32 x 5/8 | 24 Washer, flat, #10                |                                  |
|   |                              | 25 Nut, self-locking, #10-32        |                                  |

*Figure 3-18. Damper door control, exploded view.*

## Section VIII. ELECTRICAL SYSTEM AND FAN AND BLOWER MOTORS

### 3-33. General

The electrical system (fig. 1-6) consists of the compressor, fan motors, contactors, solenoid valves, selector switch, temperature control thermostat fuses, circuit breaker, heaters, heater high temperature cutout, high and low pressure cutouts, transformer, RFI filters, time delay relay and all internal wiring. An internal compressor overload protector and a manual reset circuit

breaker prevent the compressor from being damaged by electrical overload. The compressor heater thermostat cuts off the power of the compressor heater when the compressor reaches safe operating temperature and also activates the heater when required. Both evaporator fans are driven by the blower motor which has integral overload protection. The evaporator heater cutout prevents overheating when the unit is operating on the heating cycle.

### 3-34. Fuse Replacement

a. *General.* The air conditioner is provided with three cartridge-type fuses located in the upper corner of the junction box.

b. *Maintenance Procedure.* Refer to figure 3-14 and perform fuse replacement as required.

### 3-35. Electrical Leads

When removing or replacing components of the air conditioner, always inspect condition of all wires and cables. Repair or replace any defective wiring (wiring diagram, fig. 1-6).

### 3-36. Evaporator Blower and Condenser Fan Motors

a. *On-Equipment Testing.* Test the motors for resistance with a multimeter set on the low ohm scale. Touch the leads of the multimeter to the pins in the receptacle connector on the motor. On Model MAC4V60-360-3, the multimeter should indicate an approximate value of 2.25 ohms. On Model MAC6V60-360-2, the reading should be approximately 4.7 ohms. Set multimeter on the highest ohm scale. Connect one lead of the multimeter to the motor frame and touch the other lead to any of the three pins. Continuity should not exist.

b. *Removal.* Refer to figures 3-15 and 3-16, and remove the fan motors.

c. *Installation.* Install the motors in reverse order of removal as illustrated on figure 3-15 and 3-16.

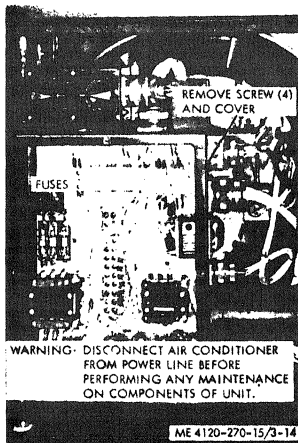


Figure 3-14. Fuse replacement.

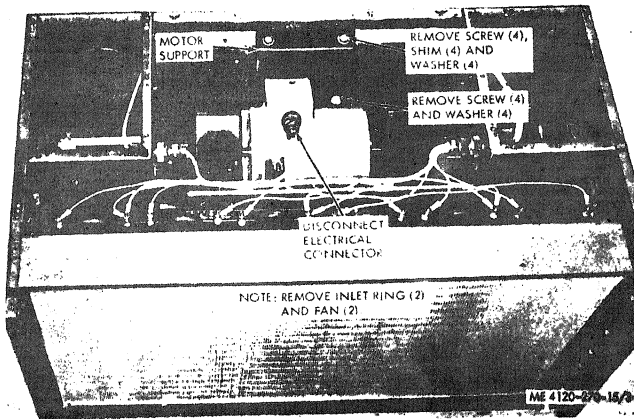


Figure 5-15. Evaporator fan motor, removal and installation.

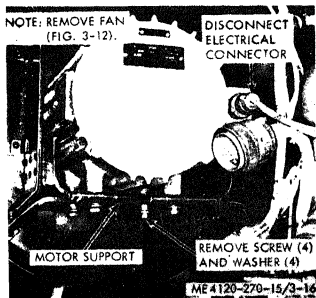


Figure 5-16. Condenser fan motor, removal and installation.



# CHAPTER 4

## DIRECT AND GENERAL SUPPORT AND DEPOT MAINTENANCE INSTRUCTIONS

### Section I. GENERAL

#### 4-1. Scope

These instructions are published for the use of direct and general support and depot maintenance personnel maintaining the Trane Model MAC4V60-360-3 and MAC6V60-360-2 Air Conditioners. They provide information on the maintenance of the equipment, which is beyond

the scope of the tools, equipment, personnel, supplies normally available to using organizations.

#### 4-2. Record and Report Forms

For record and report forms applicable to direct and general support and depot maintenance, refer to TM 38-750.

### Section II. DESCRIPTION AND TABULATED DATA

#### 4-3. Description

A general description of the air conditioner, the location and description of the identification and instruction plates, and information on the differences in models are contained in Chapter 1, Section II, of this manual. Direct and general support and depot maintenance and repair instructions are described in subsequent sections of this manual.

#### 4-4. Tabulated Data

a. *General.* This paragraph contains all the overhaul data pertinent to direct and general support and depot maintenance personnel. Refer to figure 1-6 for wiring diagrams.

##### b. Air Conditioner Classification and Rating.

Model	MAC4V60-360-3	MAC6V60-360-2
Cooling capacity	60,000 BTU/H	60,000 BTU/H
Heating capacity:		
Hi-heat	52,000 BTU/H	49,000 BTU/H
Lo-heat	26,000 BTU/H	24,500 BTU/H
Ventilating capacity	2,000 CFM	2,000 CFM
Model	MAC4V60-360-3	MAC6V60-360-2
Operating Voltage	208V AC	208V AC
Phase	3	3
Frequency	400 cycles	60 cycles
Current input,		
FL:		
Cooling	72 amperes	55 amperes
Hi-heat	61 amperes	58 amperes
Lo-heat	34 amperes	31 amperes

##### Power input:

Cooling	19.4 KW	15.5 KW
Hi-heat	16.7 KW	15.0 KW
Ventilating	2.9 KW	1.2 KW

Note. Locked rotor (LR) current input is approximately 3 times full load (FL) current input.

##### c. Compressor Classification and Rating.

Type	Reciprocating piston, hermetically sealed.
Number of cylinders	3
Bore	2 inches
Stroke	31/32 inches
Displacement	9.00 cubic inches (Approx.)
Lubrication	Forced feed
Crankcase capacity	6 pints
Crankcase heater	120 watts
Motor rating	6 HP
Motor protection	External circuit breaker and internal automatic reset thermal overload cutout.

##### d. Condenser Fan Motor Classification and Rating.

Type	Induction, squirrel cage rotor single shaft
Duty	Continuous
Drive	Direct
Protection	Automatic reset internal thermal overload and over current.
	MAC4V60-360-3    MAC6V60-360-2
Rating	5.0 HP    4.0 HP
Voltage	208V AC    208V AC
Phase	3    3
Frequency	400 cycles    60 cycles

### *e. Evaporator Fan Motor Classification and Rating.*

Type.....	Induction, squirrel cage rotor, double extended shaft.
Duty.....	Continuous
Drive.....	Direct
Protection.....	Automatic reset internal thermal overload and overcurrent.
	MAC4V60-560-S    MAC6V60-560-S
Rating.....	1.60 HP.....1.25 HP
Voltage.....	208V AC.....208V AC
Phase.....	3.....3
Frequency.....	400 cycles.....60 cycles
Speed.....	3600 rpm.....3450 rpm

### *f. Electric Heaters Classification and Rating.*

Type.....	Folded, stainless steel-sheathed tubular elements.
Rating (at 120 volts).....	2100 watts each
Duty.....	Continuous
Protection.....	Automatic reset external overload and overcurrent.

### *g. Temperature Control Thermostat Classification and Rating.*

Type.....	Single pole, double-throw, normally closed bimetallic element.
Range.....	+40°F to +90°F
Closing differential.....	2° ± 1°F

### *h. Selector Switch Classification and Rating.*

Type.....	Rotary, five positive dent positions.
Rating.....	15 amperes at 208V AC

### *i. Heater High Temperature Cutout Classification and Rating.*

Type.....	Automatic reset thermal overload and overcurrent, normally closed.
Range.....	Closed 140° ± 9°F; open 190° ± 9°F

### *j. Magnetic Contactor Classification and Rating.*

Type.....	Three-pole, single-throw, normally open, class A5.
Duty.....	Continuous
Control coil.....	28V DC

Rating:	50 amperes at 208V AC (2 per unit)
(2).....	25 amperes at 208V AC (3 per unit)

### *k. Time Delay Relay Classification and Rating.*

Type.....	Single-pole, single-throw, normally open, thermal delay, hermetically sealed.
Delay.....	30 seconds
Rating.....	3 amperes at 28V DC

### *l. Circuit Breaker Classification and Rating.*

Type.....	Manual reset double-pole, double-throw with single-pole, single-throw auxil-
-----------	--

### *l. Trip time, main breaker:*

Locked rotor.....	1.5 — 6.0 seconds
Rated overload.....	30 minutes maximum
Rating, main breaker.....	MAC4V60-560-S    MAC6V60-560-S
Must hold.....	49.0 amperes.....44.2 amperes
Must trip.....	61.2 amperes.....50.8 amperes
Rating, auxiliary.....	2.5 amperes at 250V AC

### *m. Transformer Classification and Rating.*

Type.....	Stepdown, single phase
Input voltage.....	208V AC
Output voltage.....	30V AC
Output current.....	2.2 amperes continuous; 7.7 amperes surge.

### *n. Rectifier Classification and Rating.*

Type.....	Silicon rectifier full-wave bridge, stud mount case.
Input voltage.....	30V AC
Output voltage.....	24V AC
Output current.....	3.0 amperes maximum

### *o. RFI Filter Classification and Rating.*

Type.....	Feed through
Rating.....	5 amperes at 250V AC

### *p. Expansion Valve Classification and Rating.*

Type.....	Compensated thermal expansion, remote bulb.
Superheat.....	10° ± 1/2°F
Rating.....	4 1/2 ton (1 per unit) and 2.1 ton (1 per unit)

### *q. High Pressure Cutout Classification and Rating.*

Type.....	Manual reset, normally closed pressure operated single-pole, single-throw.
Trip pressure.....	445 ± 10 psig (pounds per square inch gage).
Reset pressure.....	400 psig

### *r. Low Pressure Classification and Rating.*

Type.....	Manual reset, normally closed pressure operated single-pole, single-throw.
Trip pressure.....	7 ± 5 psig
Reset pressure.....	12 ± 5 psig

### *s. Solenoid Valve Classification and Rating.*

Type.....	Normally open, pilot operated with integral seat and resilient disc.
-----------	--

### *Coil voltage:*

Pull-in.....	20.4V DC
Release.....	18.0V DC
Coil current.....	0.51 amperes (holding).

### *t. Back Pressure Regulating Valve Classification and Rating.*

Type.....	Pressure operated, normally closed.
Operating range.....	0-90 psig
Opening pressure.....	58 psig preset, adjustable.

### *u. Pressure Relief Valve Classification and Rating.*

Type.....	Spring loaded, normally closed, non-adjustable.
-----------	---

## CHAPTER 5

### GENERAL MAINTENANCE INSTRUCTIONS

#### Section I. SPECIAL TOOLS AND EQUIPMENT

##### 5-1. Special Tools and Equipment

No special tools or equipment are required to perform direct and general support and depot maintenance on the air conditioner.

##### 5-2. Specially Designed Tools and Equipment

No specially designed tools and equipment are required to perform direct and general support and depot maintenance on the air conditioner.

#### Section II. TROUBLESHOOTING

##### 5-3. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner or any of its components. Each trouble symptom stated is followed by a list of probable causes. The possible remedy recommended is described opposite the probable cause.

##### 5-4. Compressor Fails to Start

Probable cause	Possible remedy
Defective selector switch.....	Test selector switch (para 6-2). Replace if defective.
Defective circuit breaker.....	Test circuit breaker (para 6-4). Replace if defective.
Defective compressor motor contactor	Test contactor (para 6-5). Replace if defective.
Defective time delay relay.....	Test time delay relay (para 6-6). Replace if defective.
Defective compressor motor protective relay	Test relay (para 6-6). Replace if defective (para 5-24).
Open or shorted control circuits	Perform continuity tests (para 6-12). Repair or replace defective component.
Defective compressor motor.....	Test compressor or motor (para 6-26). Replace compressor if motor is defective (para 5-24).
Compressor damaged internally	Replace compressor (para 5-24).
Defective control circuit transformer	Test transformer (para 6-7). Replace if defective.
Defective control circuit rectifier	Test rectifier (para 6-8). Replace if defective.
Defective RFI filters.....	Test filters (para 6-8). Replace if defective.
Shorted control coil in hot gas bypass solenoid valve	Test control coil (para 6-18). Repair or replace if defective.

##### 5-5. Compressor Starts Normally, but Stops on Overload

Probable cause	Possible remedy
Incorrectly set or defective thermal expansion valves	Set thermal expansion valves to correct superheat (para 6-17). Replace thermal expansion valves if correct adjustment cannot be obtained or if valves fail to modulate refrigerant flow correctly.
Defective liquid line or hot gas line solenoid valves	Test control coils (para 6-18). Check valves for positive opening and closing. Replace solenoid valves if defective.
Bent or kinked refrigerant tubing	Visually inspect all tubing for damage. Replace damaged sections (para 6-16).
Overcharge of refrigerant.....	Carefully open pressure line access valve with air conditioner operating and bleed excess refrigerant (para 6-28).

##### 5-6. Reduced Cooling Capacity

Probable cause	Possible remedy
Dirty, clogged or damaged evaporator coil	Clean evaporator coil (para 6-23). Repair or replace if damaged.
Evaporator coil frosting	Adjust back pressure regulating valve to specification (para 6-20). Replace valve if correct adjustment cannot be obtained.
Insufficient refrigerant in system	Test, evacuate and recharge system (para 6-23, 29, 30).
Defective temperature control thermostat	Test thermostat (para 6-3). Replace if defective.

Probable cause	Possible remedy	Probable cause	Possible remedy
Incorrectly set or defective thermal expansion valves	Set valves to correct superheat (para 6-17). Replace valves if correct adjustment cannot be obtained or if valves fail to modulate refrigerant flow correctly.	HIGH DISCHARGE PRESSURE	
Defective solenoid valves	Test control coils (para 6-18). Check valves for positive opening and closing. Replace defective valves.	Restricted air flow over condenser	Clean condenser coil (para 8-11) grilles and screens.
Defective evaporator fan motor	Test motor (para 6-9). Repair or replace if defective.	Incorrectly set or defective expansion valves	Set valves to correct superheat (para 6-17). Replace if defective.
		Defective solenoid valves	Test valves (para 6-18). Replace if defective.
		Restricted discharge line	Replace damaged sections (para 6-16).
		Excessive refrigerant	Bleed excess refrigerant (para 6-28).

## 7. System Malfunction or Combination of Malfunctions

Probable cause	Possible remedy
Abnormal system operating pressures	Perform operating pressure test (para 6-14).
LOW SUCTION PRESSURE	
Unconditioned area temperature excessively low	Raise thermostat temperature setting.
Restricted air flow over evaporator	Clean mist eliminator and evaporator coil (para 8-10), air filters (para 8-26) and grilles and screens.
Incorrectly set or defective expansion valves	Set valves to correct superheat (para 6-17). Replace if defective.
Insufficient refrigerant	Test, evacuate and recharge system (para 6-28, 29, 30).
Restricted suction line	Replace damaged sections (para 6-16).
Incorrectly set or defective suction pressure regulating valve	Set valve to specification (para 6-20). Replace if defective.
Defective compressor	Replace compressor (para 5-24).
HIGH SUCTION PRESSURE	
Unconditioned area temperature excessively high	Normal operation; self correcting as temperature drops.
Incorrectly set or defective expansion valves	Set valves to correct superheat (para 6-17). Replace if defective.
Defective hot gas bypass solenoid valve	Test valve (para 6-18). Replace if defective.
Defective compressor	Replace compressor (para 5-24).
LOW DISCHARGE PRESSURE	
Insufficient refrigerant	Test, evacuate and recharge system (para 6-28, 29, 30).
Defective compressor	Replace compressor (para 5-24).

## 5-8. Blower Motor Fails to Start or Stops on Overload

Probable cause	Possible remedy
Defective selector switch	Test selector switch (para 6-2). Replace if defective.
Defective fan motor contactor	Test contactor (para 6-5). Replace if defective.
Defective fan motor protective relay	Test relay (para 6-9). Replace if defective.
Open or shorted control circuit.	Perform continuity tests (para 6-12). Repair or replace defective component.
Defective fan motor	Test motor (para 6-9). Repair or replace if defective.
Defective control circuit transformer	Test transformer (para 6-7). Replace if defective.
Defective control circuit rectifier	Test rectifier (para 6-8). Replace if defective.
Defective RFI filters	Test RFI filters (para 6-8). Replace if defective.

## 5-9. No Heat in "HEAT" Position

Probable cause	Possible remedy
Defective selector switch	Test selector switch (para 6-2). Replace if defective.
Defective temperature control thermostat	Test thermostat (para 6-8). Replace if defective.
Defective heater high temperature cutout	Test high temperature cutout (para 6-11). Replace if defective.
Defective or damaged heater elements	Test heaters (para 6-10). Replace if damaged or defective.
Defective heater contactors	Test contactors (para 6-5). Replace if defective.
Open or shorted control circuits	Perform continuity tests (para 6-12). Repair or replace defective component.
Defective control circuit transformer	Test transformer (para 6-7). Replace if defective.
Defective control circuit rectifier	Test rectifier (para 6-8). Replace if defective.
Defective RFI filters capacitors	Test RFI filters (para 6-8). Replace if defective.



## 5-10. Reduced Heating Capacity

Probable cause	Possible remedy
Restricted air flow over evaporator	Clean mist eliminator and evaporator coil (para 3-10), air filters (para 3-9) and grilles and screens.
Defective selector switch ("LO HEAT" only)	Test selector switch (para 6-2). Replace if defective.
Defective temperature control thermostat	Test thermostat (para 6-3). Replace if defective.

Probable cause	Possible remedy
Defective or damaged heater elements	Test heaters (para 6-10). Replace if damaged or defective.

## 5-11. Inoperative Compressor Crankcase Heater

Probable cause	Possible remedy
Defective or damaged heating element	Test heaters (para 6-27). Replace if damaged or defective.

## Section III. RADIO INTERFERENCE SUPPRESSION

### 5-12. General

Refer to TM 11-483 for definitions, purposes, source and methods used to obtain proper radio frequency interference suppression.

### 5-13. Interference Suppression Components

The four air conditioner RFI filters (fig. 3-6) mounted on the junction box, are 5 amp, 250-volt, feed-through units.

### 5-14. Replacement of Suppression Components

- Removal.* Refer to figure 3-7 and remove radio interference suppression components.
- Testing.* Test filters on a continuity tester to replace defective RFI filters.
- Installation.* Refer to figure 3-7 and install radio interference suppression components by reversing removal procedure.

## Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS OR AUXILIARIES

### 5-15. General

The air conditioner, after it is started, is automatic in operation. The relationship of the automatic components, controls, and instruments, is explained in the operating cycle description for maintenance of the air conditioner (para 5-16). A refrigerant flow diagram (fig. 5-1) and practical wiring diagram (fig. 1-6) are included to assist in the maintenance of the electrical components, wiring harness, wire leads, and refrigerant components.

**Warning:** Disconnect the air conditioner from the power source before performing any maintenance on the components of the unit.

### 5-16. Description of Operating Cycle

a. *General.* The type and degree of air conditioning provided by the unit is controlled by a five-position selector switch and a temperature control (temperature control thermostat).

(1) On units with reciprocating piston compressors the crankcase heater is in constant operation.

(2) Placing the selector switch in the HI-HEAT position actuates the blower motor with both banks of evaporator heaters being under the control of the temperature control. If the air tem-

perature control the control contacts close, energizing the contactors which supply power to the heaters through the normally closed contacts of the heater high temperature cutout.

(3) Moving the selector switch to the LO HEAT position presents the same control sequence but reduces the heating capacity of the unit by supplying power to a single bank of heaters only.

(4) The blower motor starts when the selector switch is placed in the VENTILATE position.

(5) In the "COOL" position, the blower motor is in operation and the compressor motor contactor is energized through the normally closed contacts of the circuit breaker and the compressor overload protector. After the blower motor and compressor have started, the flow within the refrigerant system is controlled by the temperature control thermostat. Sensing a rise in the air temperature above the set point, the temperature control thermostat closes, positioning the valves for cooling service. Sensing a fall in the air temperature below the set point, the contacts of the temperature control thermostat open, positioning the valves for bypass service.

b. *Compressor Operation.* The compressor delivers refrigerant gas to the condenser at the

desired temperature is attained, the same valves bypass the evaporator coil to prevent further cooling of the conditioned area. The compressor operates continuously whenever the selector switch is on "COOL" to prevent voltage fluctuations in the power line. A time delay relay keeps the hot gas bypass valve open and prevents operation of the compressor for 30 seconds after initial startup.

*Note.* Hot gas bypass solenoid valve V<sub>1</sub> remains at all times during cooling cycle and bypass cycle operation. It opens when selector switch is moved from "COOL" position and remains open for 30 seconds after selector switch is returned to "COOL" position.

*c. Cooling Cycle of Operation.* When the conditioned area temperature rises above the temperature control thermostat setting, a set of contacts opens, permitting liquid line solenoid valve V<sub>1</sub> to return to its normally open position. Liquid refrigerant is metered to the evaporator coil by thermal expansion valve W<sub>1</sub>. Thermal expansion valve W<sub>2</sub> bypasses a small amount of liquid refrigerant to the suction line to maintain a constant load on the compressor. The back pressure regulating valve (BPR) prevents evaporator coil icing and loss of efficiency. The condenser receiver and accumulators further stabilize the system.

*d. Bypass Cycle of Operation.* When the conditioned area temperature falls below the temperature control thermostat setting, a set of contacts closes, energizing the pull-in coil of liquid line solenoid valve V<sub>1</sub>, and blocking the flow of liquid refrigerant to the evaporator coil. Suction pressure increases and the back pressure regulating valve (BPR) opens to bypass hot refrigerant gas to the suction line. At the same time, thermal expansion valve W<sub>2</sub> meters increased amounts of liquid refrigerant into the suction line to maintain a constant load on the compressor. The condenser receiver and accumulators further stabilize the system.

*e. Heating Operation.* Placing the selector switch in the "LO HEAT" position actuates half of the evaporator heaters mounted in the conditioned air stream, directly behind the evaporator coil. When the selector switch is placed in the "HI HEAT" position, the remaining heaters are energized, providing maximum heating capacity.

## 5-17. Cover Panel

*a. Removal.* Refer to figure 3-8 and remove cover panel.

## 5-18. Control Panel

*a. Removal.* Refer to figure 5-2 and remove control panel.

*Note.* Use care in removing temperature control thermostat remote bulb and capillary tubing.

*b. Installation.* Refer to figure 5-2 and install control panel.

## 5-19. Junction Box

*a. Removal.* Refer to figure 5-2 and remove junction box.

*b. Installation.* Refer to figure 5-2 and install junction box.

## 5-20. Electrical Heaters and High Temperature Cutout

*a. Removal.* Refer to figure 5-3 and remove electrical heaters and high temperature cutout.

*b. Installation.* Refer to figure 5-3 and install electric heaters and high temperature cutout.

## 5-21. Evaporator Fan Motor

*a. Removal.* Refer to figure 3-15 and remove evaporator fan motor.

*b. Installation.* Refer to figure 3-15 and install evaporator fan motor.

## 5-22. Sight Glass

*a. Removal.* Refer to figure 5-4 and remove sight glass.

*b. Installation.* Refer to figure 5-4 and install sight glass.

## 5-23. Evaporator Coil

*a. Removal.* Refer to figure 5-5 and remove evaporator coil.

*b. Installation.* Refer to figure 5-5 and install evaporator coil.

## 5-24. Compressor

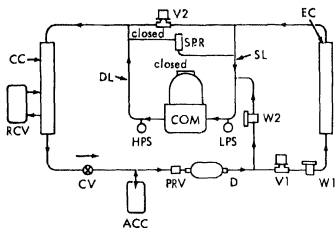
*a. Removal.* Refer to figure 5-6 and remove compressor.

*b. Installation.* Refer to figure 5-6 and install compressor.

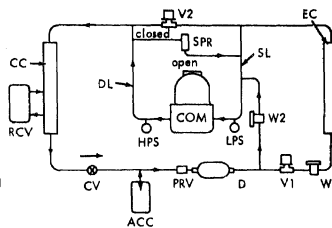
## 5-25. Expansion Valves

*a. Removal.* Refer to figure 5-7 and remove expansion valves.

*Note.* Use care in removing remote sensing bulb and capillary tubing.



A. COOLING CYCLE OF OPERATION



B. BYPASS CYCLE OF OPERATION

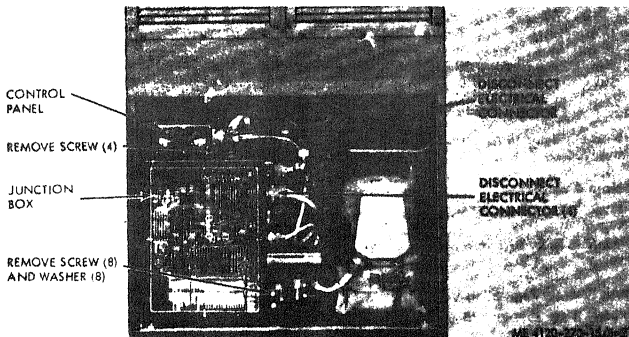
ACC ACCUMULATOR (2)  
CC CONDENSER COIL  
COM COMPRESSOR  
CV CHECK VALVE  
D DEHYDRATOR  
DL DISCHARGE LINE  
EC EVAPORATOR COIL  
HPS HIGH PRESSURE CUTOFF SWITCH  
LPS LOW PRESSURE CUTOFF SWITCH

#### DEVICE LEGEND

PRV PRESSURE RELIEF VALVE  
RCV RECEIVER  
SL SUCTION LINE  
SPR SUCTION PRESSURE REGULATOR VALVE  
V1 LIQUID LINE SOLENOID VALVE  
V2 HOT GAS BYPASS SOLENOID VALVE  
W1 EVAPORATOR FEED THERMAL EXPANSION VALVE  
W2 BYPASS THERMAL EXPANSION VALVE

ME 4120-270-15/5-1

Figure 5-1. Refrigerant flow diagram.



ME 4120-270-15/5-2

Figure 5-2. Control panel and junction box removal and installation

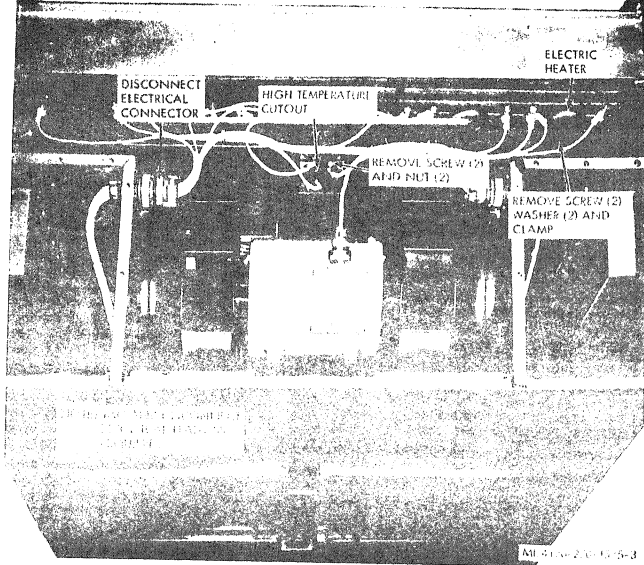


Figure 5-8. Electric heaters and high temperature cutout, removal and installation.

b. *Installation.* Refer to figure 5-7 and install expansion valves.

#### 5-26. Solenoid Valves

a. *Removal.* Refer to figure 5-8 and remove solenoid valves.

b. *Installation.* Refer to figure 5-8 and install solenoid valves.

#### 5-27. Back Pressure Regulating Valve

a. *Removal.* Refer to figure 5-9 and remove back pressure regulating valve.

b. *Installation.* Refer to figure 5-9 and install back pressure regulating valve.

#### 5-28. High and Low Pressure Cutout Switches

a. *Removal.* Refer to figure 5-10 and remove high and low pressure cutout switches.

b. *Installation.* Refer to figure 5-10 and install high and low pressure cutout switches.

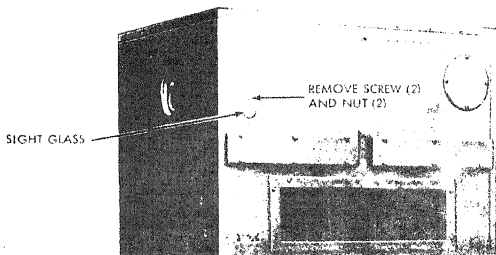
#### 5-29. System Access Valve

a. *Removal.* Refer to figure 5-11 and remove system access valves.

b. *Installation.* Refer to figure 5-11 and install system access valves.

#### 5-30. Pressure Relief Valve

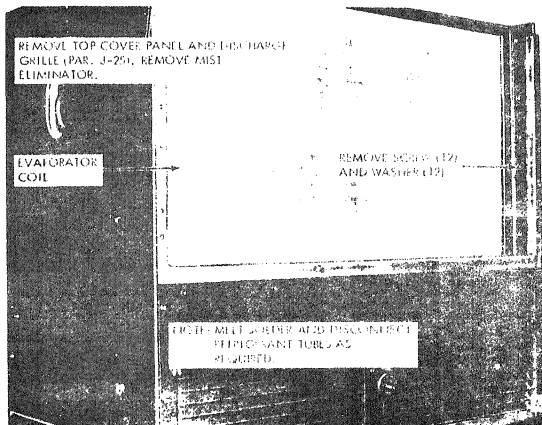
a. *Removal.* Refer to figure 5-12 and remove pressure relief valve.



NOTE: MELT SOLDER AND DISCONNECT REFRIGERANT TUBE (2) FROM REAR OF SIGHT GLASS.

ME 4120-270-15/5-4

Figure 5-4. Sight glass, removal and installation.



ME 4120-270-15/5-5

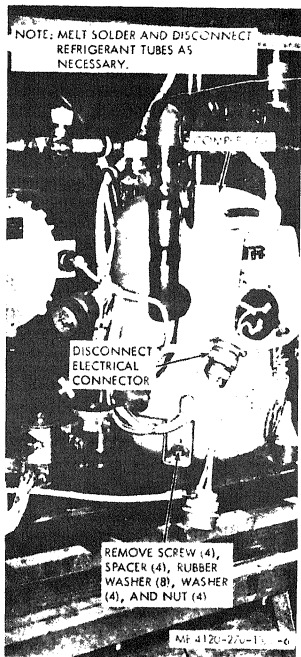
Figure 5-5. Evaporator coil, removal and installation.

b. *Installation.* Refer to figure 5-12 and install pressure relief valve.

### 5-31. Dehydrator

a. *Removal.* Refer to figure 5-12 and remove dehydrator.

b. *Installation.* Refer to figure 5-12 and install dehydrator.



### 5-32. Condenser Coil

a. *Removal.* Refer to figure 5-13 and remove condenser coil.

b. *Installation.* Refer to figure 5-13 and install condenser coil.

### 5-33. Condenser Fan Motor

a. *Removal.* Refer to figure 3-16 and remove condenser fan motor.

b. *Installation.* Refer to figure 3-16 and install condenser fan motor.

### 5-34. Fresh Air Damper Assembly

a. *Removal.* Refer to figure 3-13 and remove fresh air damper assembly.

b. *Installation.* Refer to figure 3-13 and install fresh air damper assembly.

### 5-35. Condensate Drain Tube

a. *Removal.* Refer to figure 5-14 and remove condensate drain tube.

b. *Installation.* Refer to figure 5-14 and install condensate drain tube.

### 5-36. Thermal Insulation

a. *Removal.* Refer to figure 5-15 and remove thermal insulation.

b. *Installation.* Refer to figure 5-15 and install thermal insulation.

### 5-37. Casing Assembly

a. *Removal.* Refer to figure 5-15 and remove casing assembly.

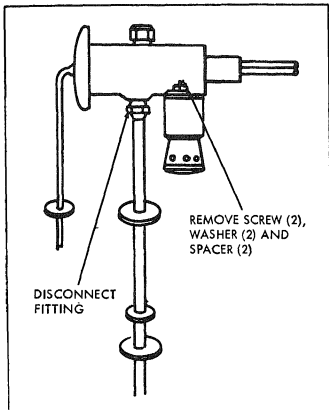
b. *Installation.* Refer to figure 5-15 and install casing assembly.

### 5-38. Base Assembly

a. *Removal.* Refer to figure 5-15 and remove base assembly.

b. *Installation.* Refer to figure 5-15 and install base assembly.

Figure 5-6. Compressor, removal and installation.



NOTE: MELT SOLDER AND DISCONNECT REFRIGERATION TUBES AS REQUIRED.

ME 4120-270-15/5-7 ①

Figure 5-7 (1). Expansion valve, removal and installation.



Figure 5-7 (2)—Continued.

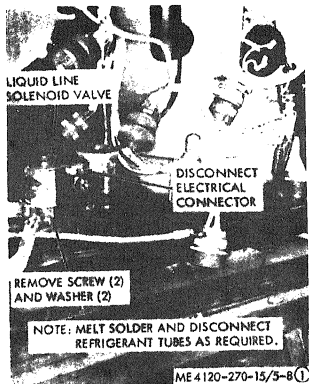


Figure 5-8 (1). Solenoid valve, removal and installation.

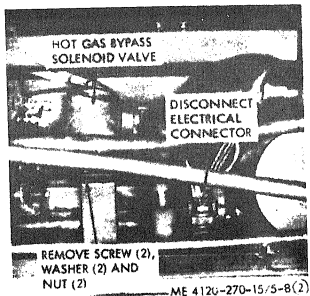


Figure 5-8 (2)—Continued.

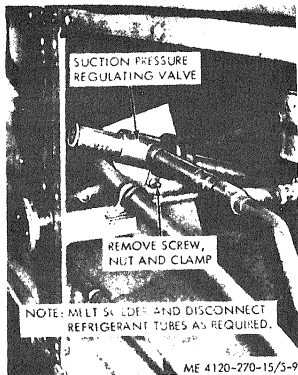


Figure 5-9. Back pressure regulating valve, removal and installation.

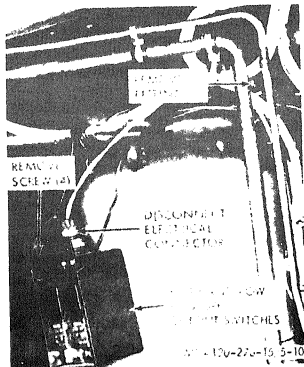
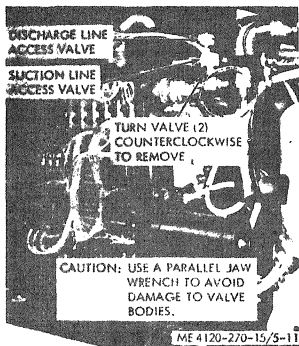
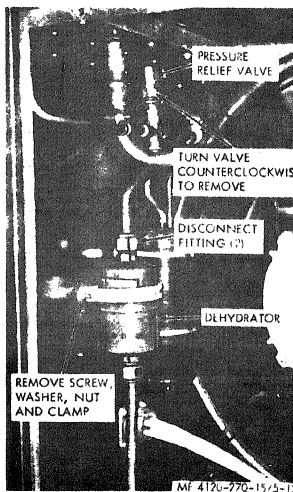


Figure 5-10. High and low pressure cutout switches,





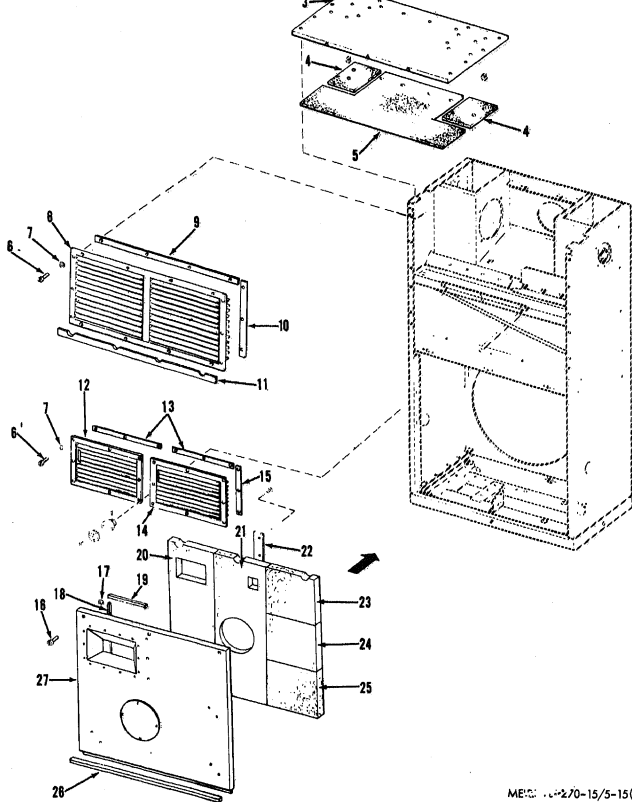
*Figure 5-11. System access valves, removal and installation.*



*Figure 5-12. Pressure relief valve and dehydrator, removal and installation.*





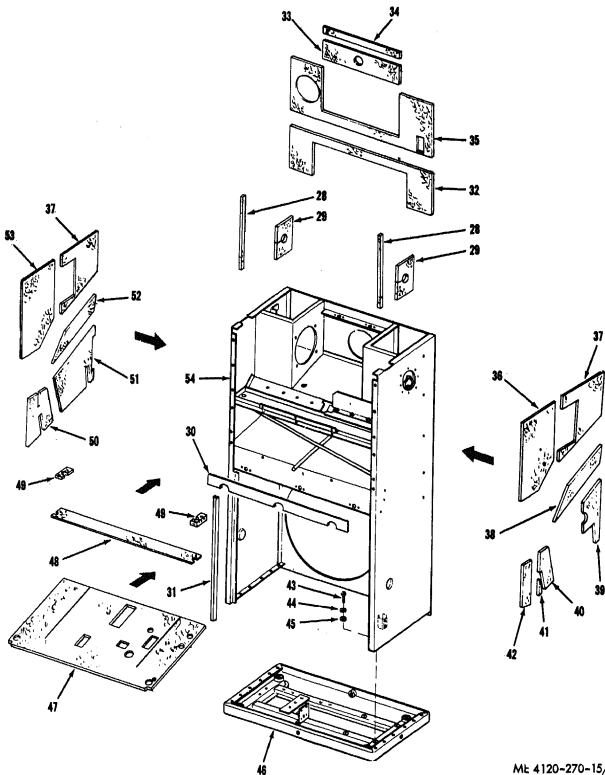


ME:G 10-270-15/5-15 ①

Figure 5-15 (1). Thermal insulation, casing and base assembly, exploded view.

4 Insulation, rubber	13 Gasket, rubber	23 Strip, retaining
5 Insulation, rubber	14 Grille, intake, RH	23 Insulation, rubber
6 Screw, machine, # 10-32 x 3/4 in.	15 Gasket, rubber	24 Insulation, rubber
7 Washer, flat #10	16 Screw assembly	25 Insulation, rubber
8 Grille, discharge	17 Washer, retaining	26 Gasket, rubber
		27 Panel, lower

*Figure 5-15 (1)—Continued.*



ME 4120-270-15/5-15 (2)

Key to fig. 5-15 (2):  
 28 Gasket, rubber  
 29 Insulation, rubber  
 30 Gasket/ rubber  
 31 Gasket, rubber

32 Insulation, rubber  
 33 Insulation, rubber  
 34 Insulation, rubber  
 35 Insulation, rubber  
 36 Insulation, rubber  
 37 Insulation, rubber

38 Insulation, rubber  
 39 Insulation, rubber  
 40 Insulation, rubber  
 41 Insulation, rubber  
 42 Insulation, rubber  
 43 Insulation, rubber  
 44 Insulation, rubber  
 45 Insulation, rubber  
 46 Insulation, rubber  
 47 Insulation, rubber  
 48 Insulation, rubber  
 49 Insulation, rubber  
 50 Insulation, rubber  
 51 Insulation, rubber  
 52 Insulation, rubber

Figure 5-15 (2)—Continued

42 Insulation, rubber	47 Insulation, rubber	52 Insulation, rubber
43 Screw, machine, 1/4-28 x 3/4 in.	48 Insulation, rubber	53 Insulation, rubber
44 Washer, lock, 1/4 in.	49 Insulation, rubber	54 Casing assembly
45 Washer, flat, 1/4 in.	50 Insulation, rubber	
46 Base assembly	51 Insulation, rubber	

*Figure 5-15 (2)—Continued.*

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## CHAPTER 6

### SPECIFIC REPAIR INSTRUCTIONS

#### Section I. ELECTRICAL SYSTEM

##### 6-1. General

This section contains those items which are considered part of major components or auxiliaries of the air conditioner electrical system. They consist of control circuit components, leads, heating elements, relays and electric motors.

##### 6-2. Selector Switch

*a. General.* The selector switch is a manually operated, five-position rotary switch which is used to turn on the "COOL", "HEAT" and "VENTILATE" modes and to turn off the air conditioner.

*b. Removal.* Refer to figure 6-1 and remove the selector switch from the control panel.

*c. Disassembly.* Disconnect electrical leads from selector switch. Do not disassemble further.

*d. Testing.* Using a multimeter set on OHMS, refer to figure 6-2 and test for continuity or open circuit as indicated on the chart. Replace the selector switch if it fails to operate as specified.

*e. Reassembly.* Connect electrical leads to selector switch.

*f. Installation.* Refer to figure 6-1 and install the selector switch in the control panel.

##### 6-3. Temperature Control Thermostat

*a. General.* The temperature control thermostat is a temperature sensing manually set single-pole double-throw switch which automatically controls both heating and cooling cycles to maintain any selected conditioned area temperature between +40°F and +90°F.

*b. Removal.* Refer to figure 6-1 and remove the temperature control thermostat from the control panel.

*c. Disassembly.* Disconnect electrical leads from temperature control thermostat. Do not disassemble further.

*d. Testing.*

(1) Rotate shaft so flat faces away from terminals. Using a multimeter set on OHMS, refer

to figure 6-3 and test for continuity between each of the control terminals and the common terminal. It will be necessary to rotate the shaft clockwise ("warmer" direction) or counterclockwise ("cooler" direction) to open and close each set of contacts. Replace temperature control thermostat if contacts do not operate as indicated.

(2) The temperature control thermostat should maintain conditioned area temperature within  $2^{\circ} \pm 1^{\circ}\text{F}$  of the temperature selected. Replace temperature control thermostat if operating differential is larger than specified.

*e. Reassembly.* Connect electrical leads to temperature control thermostat.

*f. Installation.* Refer to figure 6-1 and install temperature control thermostat in the control panel.

##### 6-4. Circuit Breaker

*a. General.* The circuit breaker is a manually reset, double-pole double-throw switch which automatically protects the compressor motor from continuous or recurrent and short circuits. An electrically isolated single-pole double-throw switch protects the control circuits.

*b. Removal.* Refer to figure 6-4 and remove the circuit breaker from the junction box.

*c. Testing.*

(1) Refer to figure 6-5. With circuit breaker closed, there should be continuity between terminals 1 and 2, 3 and 5, 6 and 7.

(2) With circuit breaker open there should be no continuity between terminals 1 and 2, and 5, 6 and 7. Replace circuit breaker if operation is not as indicated.

*d. Installation.* Refer to figure 6-4 and install circuit breaker in the junction box.

##### 6-5. Magnetic Contactors

*a. General.* The magnetic contactors are controlled three-pole, single-throw switches which are used to connect the air conditioning electric motors and heaters across the

up-down transformer and rectifier circuit. The condenser fan motor and compressor motor contactors are rated at 50 amperes. The evaporator fan motor and heater contactors are rated at 25 amperes.

b. *Removal.* Refer to figure 6-4 and remove contactors from the junction box.

c. *Disassembly.* Do not disassemble unless contacts are dirty or pitted and require cleaning or dressing.

d. *Testing (fig. 6-6).*

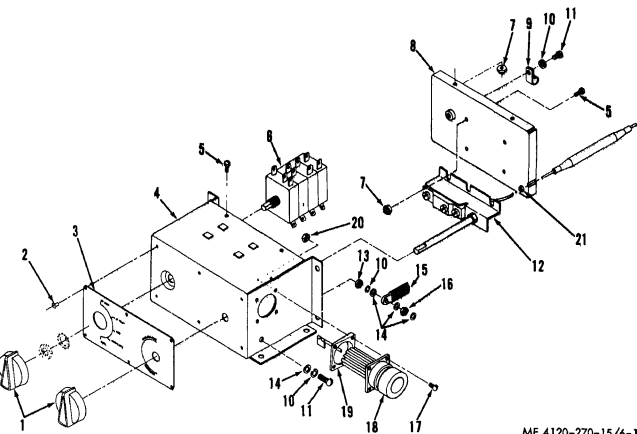
(1) *50-ampere contactors.*

(a) With contactor open, test for continu-

coil is open, replace contactor.

(b) With contactor open, test for continuity across each pair of line and load terminals  $L_1-T_1$ ,  $L_2-T_2$ , and  $L_3-T_3$ . If continuity exists, contacts are welded or contact springs are broken. Replace contactor.

(c) Using a multimeter on high OHMS range, a megger or an insulation tester, test insulation resistance between contactor frame and each terminal in turn. If insulation resistance is less than 0.5 megohm, replace contactor.



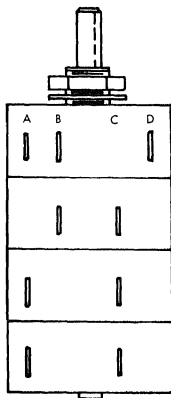
ME 4120-270-15/6-1

Key to fig. 6-1:

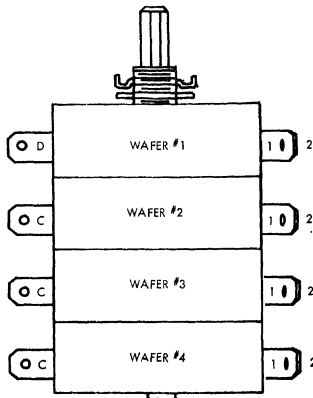
- 1 Knob
- 2 Rivet, blind
- 3 Plate, instruction
- 4 Panel, assembly
- 5 Screw, machine, pan head, No. 8-32 x 1/2 in.
- 6 Switch, selector
- 7 Nut, hex, locking, No. 8-32
- 8 Plate, mounting
- 9 Clamp, loop
- 10 Washer, lock, No. 10

- 11 Screw, machine, pan head, No. 10-32 x 1/2 in.
- 12 Switch, thermostat
- 13 Nut, hex, locking, No. 8-32
- 14 Washer, flat, No. 10
- 15 Lead, electrical, ground
- 16 Nut, hex, No. 10-32
- 17 Screw, machine, pan head, No. 6-32 x 1
- 18 Connector, receptacle, electrical
- 19 Spacer
- 20 Nut, hex, No. 6-32
- 21 Grommet

Figure 6-1. Control panel, exploded view.



TERMINAL LOCATION



RIGHT SIDE

SWITCH POSITION						
WAFA NO.	CONTACT NO.	1 HI HEAT	2 LO HEAT	3 OFF	4 VENT	5 COOL
1	2 & A	CLOSED	CLOSED	OPEN	OPEN	OPEN
	2 & B	OPEN	OPEN	OPEN	OPEN	CLOSED
	1 & D	OPEN	OPEN	OPEN	OPEN	CLOSED
2	2 & B	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
4	1 & C	CLOSED	OPEN	OPEN	OPEN	OPEN

Figure 6-8. Selector switch test sequence.

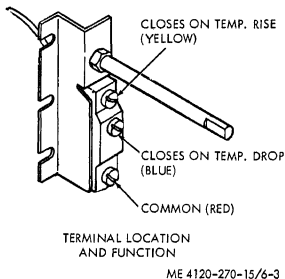


Figure 6-3. Temperature control thermostat test points.

**Caution:** Do not apply test potentials in excess of 230 volts.

(d) Energize control coil using a 24-28V DC source or two 12 volt batteries connected in series. Using a multimeter on lowest OHMS range, test contact resistance across each pair of line and load terminals  $L_1-T_1$ ,  $L_2-T_2$  and  $L_3-T_1$ . Contact resistance in excess of 0.2 ohms indicates **firry** or **burnt** contacts. Clean contacts if possible, or replace contactor.

(2) 25-ampere contactors. Proceed as instructed above, noting that line and load terminals are now  $A_1-A_2$ ,  $B_1-B_2$  and  $C_1-C_2$ . Observe same cautions.

e. *Reassembly.* Reassemble any parts that were removed for cleaning or dressing contacts.

f. *Installation.* Refer to figure 6-4 and install contactors in junction box.

## 6-6. Time Delay Relay

a. *General.* The time delay relay is a hermetically enclosed, single-pole, single-throw normally open thermal delay relay which keeps the hot gas bypass valve open and prevents operation of the compressor for 30 seconds after the selector switch is placed on "COOL". The time delay relay closes at the end of the delay period and remains closed as long as the air conditioner is on "COOL" mode. Switching to other modes of operation opens the relay. It remains open until the air conditioner is again placed on "COOL" mode, at which time it delays valve and compressor on

b. *Removal.* Refer to figure 6-4 and remove the time delay relay assembly from the junction box.

c. *Disassembly.* Do not disassemble for testing. If replacement is indicated, remove time delay relay from its mounting bracket and disconnect electrical leads.

d. *Testing.*

(1) Refer to figure 6-7 and place a continuity indicator or multimeter on low OHMS range across leads A and B.

(2) Apply 24-28V DC from a test source or two 12-volt batteries in series across leads A and C.

(3) Begin timing the relay from the instant DC power is applied until the continuity indicator or multimeter indicates the relay contacts have closed. Normal delay is 30 seconds  $\pm 3$  seconds. Replace time delay relay if delay time is not according to specifications.

e. *Reassembly.* Connect electrical leads to time delay relay and mount relay in its bracket.

f. *Installation.* Refer to figure 6-4 and install time delay relay in the junction box.

## 6-7. Transformer

a. *General.* The control circuit transformer is a single-phase, shielded, potted stepdown transformer with a 208V AC primary and a 30V AC secondary. After rectification, the resulting 24V DC output is used to energize the magnetic contactor and solenoid valve control coils and the time delay relay. The transformer primary circuit is protected by the auxiliary circuit breaker contact and by a cartridge-type fuse in each line.

b. *Removal.* Refer to figure 6-4 and remove the transformer from the junction box.

c. *Disassembly.* Disconnect electrical leads from primary and secondary terminals. Do not disassemble further.

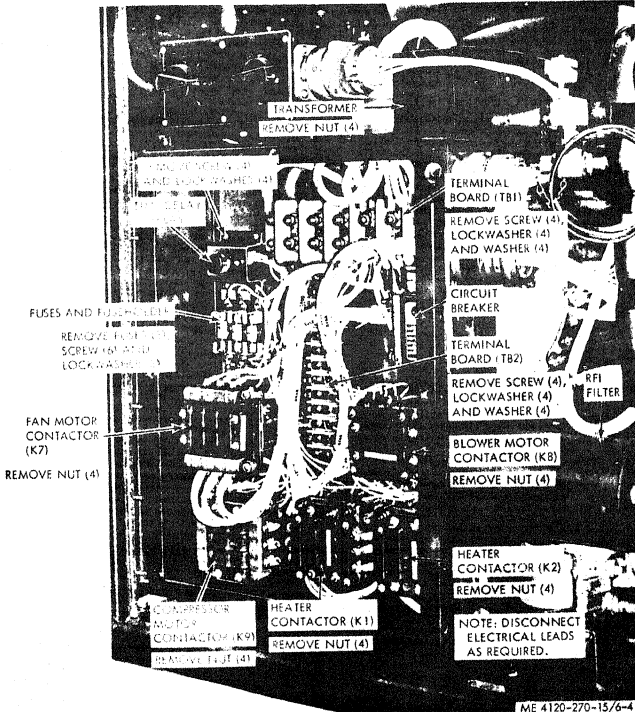
d. *Testing.*

(1) Connect a continuity tester or multimeter on low OHMS range across the transformer primary winding. If winding is open, replace transformer.

(3) Connect a continuity tester or multimeter on low OHMS range across the transformer secondary. If winding is open, replace transformer.

(3) Connect an insulation tester, megger or multimeter on high OHMS range between one primary terminal and transformer case. If resistance is less than 0.5 megohm, replace transformer.

(4) Connect an insulation tester, megger or multimeter on high OHMS range between one



ME 4120-270-15/6-4

Figure 6-4. Junction box components, removal and installation.

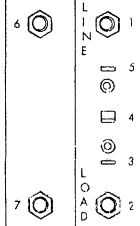
resistance is less than 0.5 megohm, replace transformer.

e. *Reassembly.* Connect electrical leads to transformer.

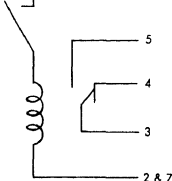
f. *Installation.* Refer to figure 6-4 and install transformer in the junction box.

## 6-8. RFI Filter Assembly

a. *General.* The RFI filter assembly contains a single-phase silicon rectifier bridge and four ferrite through filters mounted in a shielding canister provided with caps at both ends.



TERMINAL  
LOCATION



SCHEMATIC  
(CIRCUIT BREAKER OPEN)

ME 4120-270-15/6-5

Figure 6-5. Circuit breaker test points.

b. *Removal.* Refer to figure 6-4 and remove the RFI filter assembly from the side of the junction box.

c. *Disassembly.* Refer to figure 3-7 and disassemble RFI filter assembly into components.

d. *Testing.*

(1) *Rectifier.*

(a) Using a multimeter on DC VOLTS range measure rectifier output voltage across positive and negative terminals when 28V AC is applied to the AC terminals through a stepdown transformer. Rectifier output should measure  $24 \pm 5V$  DC. Replace rectifier if output voltage is less than specified.

(b) Using a multimeter on OHMS range measure rectifier resistance between terminals 1-2, 2-4, 4-3, and 3-1.

(c) Repeat above procedure, reversing leads to measure resistance between terminals 2-1, 4-2, 3-4 and 1-3.

(d) Compare reading against following chart. Replace rectifier if readings are substantially higher or lower than specified.

Terminal pair	Resistance reading
1-2	1000 ohms or higher
2-1	1 ohm or lower
2-4	1 ohm or lower
4-2	1000 ohms or higher
4-3	1 ohm or lower
3-4	1000 ohms or higher
3-1	1000 ohms or higher
1-3	1 ohm or lower

*Note.* A high ratio of reverse to forward resistance usually indicates a good rectifier. If possible, substitute a known good rectifier and check operation of air conditioner.

(2) *RFI filters.* Using a multimeter on low OHMS range or a continuity tester, check continuity between both the terminals of the RFI filters. If an open indication is obtained, replace RFI filters.

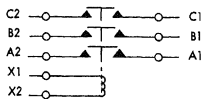
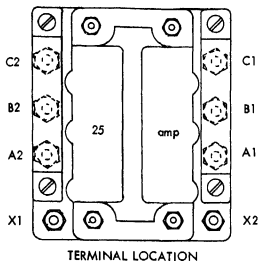
e. *Reassembly.* Refer to figure 3-7 and reassemble RFI components.

f. *Installation.* Refer to figure 6-4 and install RFI filter assembly in junction box.

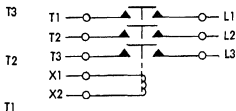
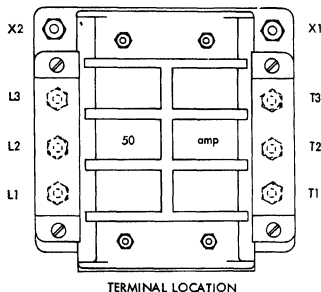
## 6-9. Evaporator Fans and Condenser Fan Electric Motors

a. *General.* The evaporator and condenser fan motors are of the squirrel cage, induction type. They provide the mechanical energy necessary to turn the evaporator blowers and condenser fan. Both motors operate on three-phase 208V AC and are connected across the line by means of individual magnetic contactors energized by the control circuit. Motors on the MAC4V60-360-3 air conditioner are designed for 400 cycle service. The MAC6V60-360-2 motors operate on 50-60 cycles. Both models are similar in appearance and are protected by internal self-resetting thermal overload and overcurrent protectors.

b. *On-Equipment Testing.* Before removing the motor for replacement, test the motor windings for opens and grounds:



SCHEMATIC  
(CONTACTOR OPEN)



SCHEMATIC  
(CONTACTOR OPEN)

ME 4120-270-15/6-6

**Figure 6-6. Magnetic contactor test points.**

(1) Disconnect receptacle connector from motor junction box.

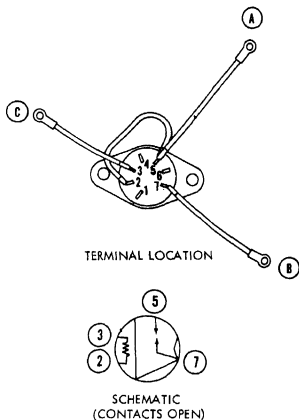
(2) Test continuity across each combination of two motor terminals. Lack of continuity indicates an open winding.

(3) Place one contact of the tester against motor housing and the other against the motor terminals one at a time. If a circuit is indicated, the motor is grounded.

(4) Test the motor stator for insulation resistance as instructed in TM 5-764 (Electric Motor and Generator Repair). The insulation resistance should measure not less than 0.5 meg-

*Note.* The resistance measurement should be used only as a general guide, taking into consideration the accuracy of the instrument used, test lead resistance, and ambient temperature at time of test. If more precise measurement is required, an instrument such as a Kelvin or Wheatstone bridge should be used, or comparative measurement between the suspected component and a like item to be good should be utilized. In all cases where a megohmmeter is used for testing, make certain that the unit is thoroughly dry. Wet condemnation tolerances should be considered.

(5) Connect the air conditioner to a proper source of power. Use a hook-type ammeter and read the amperage flowing in each of the evaporator fan motor leads. On model MAC4V60-  
amperage should be in the range between 5.75



ME 4120-270-15/6-7

Figure 6-7. Time delay relay test points.

and 4.0 amperes. On model MAC6V60-360-2 the ammeter should indicate between 4.5 and 3.14 amperes at full load. When testing the condenser fan motor, the ammeter should indicate between 18 and 12.6 amperes at full load for model MAC4V60-360-3. On model MAC6V60-360-2 the ammeter should indicate between 14.5 and 10.2 amperes at full load.

c. *Removal.* Refer to paragraphs 5-21 and 5-33 and remove fan motors.

d. *Disassembly.* Refer to figure 6-8 and 6-9 and disassemble the fan motors.

e. *Testing of Overload Protector.* Disconnect the electrical leads from the overload protector. Test the protector with a multimeter set on OHMS. If continuity does not exist, replace the overload protector.

f. *Cleaning, Inspection and Repair.*

(1) Clean all parts with a cloth dampened in cleaning solvent.

(2) Inspect the stator housing for cracks, breaks, or other defects. Replace a damaged or defective housing.

(3) Inspect bearings for pitting, scoring, wear,

(4) Inspect the rotor shaft for cracks, wear, and misalignment. Replace a damaged or defective rotor.

(5) Inspect the rotor for cracks, breaks, and damaged laminations. Replace the rotor and stator if they are damaged.

(6) Inspect all threaded parts for damage. Replace as necessary.

g. *Reassembly.* Refer to figure 6-8 and 6-9 and reassemble the fan motors.

h. *Installation.* Refer to paragraphs 5-21 and 5-33 and install the fan motors.

## 6-10. Electric Heater Elements

a. *General.* Two banks of three electrical heaters each are mounted directly behind the evaporator coil, in the conditioned air stream, and provide heat on command from the temperature control thermostat to maintain the selected ambient temperature. Placing the selector switch on "LO-HEAT" starts the evaporator blower and places one bank of heaters in operation on command from the temperature control thermostat. Placing the selector switch in "HI-HEAT" activates the second bank of heaters, which operates continuously in addition to the controlled bank.

b. *Removal.* Refer to figure 5-3 and remove the heating element assembly from air conditioner.

c. *Disassembly.* Refer to figure 5-3. Disconnect electrical leads from heating elements and remove elements from support channel assembly.

d. *Testing.* Using a multimeter set on low OHMS range, check resistance across each heating element in turn. Normal reading is  $7 \pm 4$  ohms. Replace heating element if resistance is not as specified.

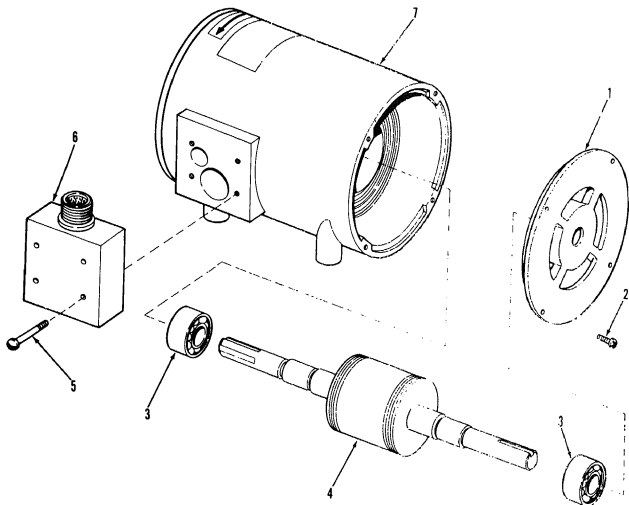
e. *Reassembly.* Refer to figure 5-3. Install elements in support channel assembly and connect electrical leads.

f. *Installation.* Refer to figure 5-3 and install heating element assembly in air conditioner.

## 6-11. Heater High Temperature Cutout

a. *General.* The heater high temperature cutout is a three-pole, single-throw, automatic reset, thermal overload and overcurrent protector which prevents the heaters from operating at discharge temperatures in excess of  $190^\circ \pm 40^\circ\text{F}$  regardless of selector switch and temperature control thermostat settings. Normal heater operation resumes automatically at  $140^\circ \pm 40^\circ\text{F}$  discharge air temperature.





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**Key to fig. 6-8:**

1 Cover, end

2 Screw, machine

3 Bearing, ball

4 Rotor and shafts

5 Screw, machine

6 Box, connector

7 Frame and windings

**Figure 6-8. Evaporator fan motor, exploded view.**

**b. Removal.** Refer to figure 5-3 and remove the heater high temperature cutout.

**c. Disassembly.** Disconnect electrical leads from heater high temperature control. Do not disassemble further.

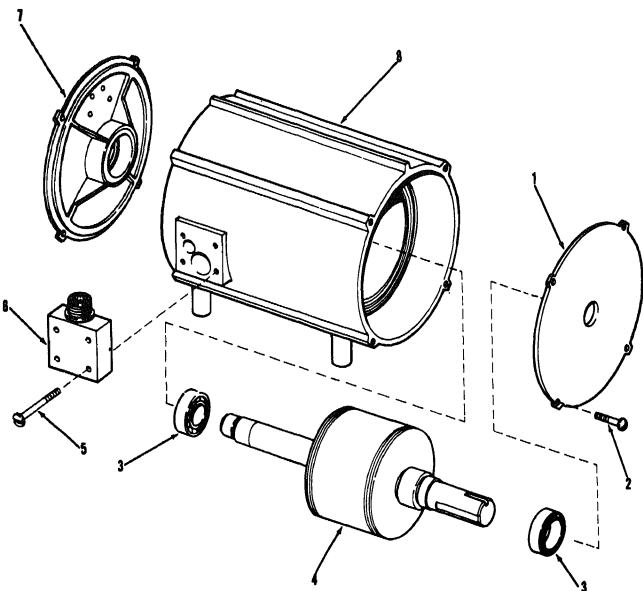
**d. Testing.** Using a continuity tester or a multimeter set on low OHMS range, test for continuity between each pair of terminals. Replace

**e. Reassembly.** Connect electrical leads to heater high temperature cutout.

**f. Installation.** Refer to figure 5-3 and install heater high temperature cutout on heater support assembly.

## 6-12. Wiring Harness and Wire Leads

**a. General.** The electrical circuits in the air



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Key to fig. 6-9:  
1 Cover, end  
2 Screw, machine

3 Bearing, ball  
4 Rotor and shaft

5 Screw, machine  
6 Box, connector

7 Cover, end  
8 Frame and windings

Figure 6-9. Condenser fan motor, exploded view.

to form a wiring harness. All of the wiring carries code numbers. When testing, repairing or replacing the wiring harness or individual wires, refer to the practical wiring diagrams, figure 1-6. Inspect all wiring installations for cracked or frayed insulation material. Pay particular attention to wires passing through holes in the frame or around sharp edges. Repair or replace defective wiring.

b. *Testing.* Test for continuity by disconnecting each end. Touch the test probes of a continuity tester or multimeter set on low OHMS range to each end of wire. If continuity is not indicated, repair or replace wire.

c. *Repair.* Remove insulation to expose 1/2 inch of bare wire on each side of break. Twist the wire ends together and solder the splice. Cover the splice with rubber or PVC electrical tape

repaired area. Replace broken terminal lugs with exact duplicates.

d. *Replacement.* Replace single wire by using exact duplicates of terminal lugs from old wire.

connect the wire at both ends and tape ends. Attach the replacement wire to the outside of the harness with PVC electrical tape. Refer to figure 1-6 for practical wiring diagrams.

## Section II. REFRIGERANT SYSTEM

### 6-13. General

This section contains those items which are considered part of major components or auxiliaries of the air conditioner refrigerant system. They consist of expansion valves, solenoid valves, pressure sensing valves and switches, compressor assembly, electric motors and refrigerant tubing.

### 6-14. Pressure Testing Under Normal Operating Conditions

If the air conditioner is losing cooling capacity, or is in some way not functioning properly, a check of refrigerant system operating pressures will frequently lead to cause of malfunction. Install pressure gages on gage ports of suction and discharge line access valves (fig. 5-11) and turn valves two turns to open, exposing gages to system pressure. Start air conditioner and compare gage readings with normal ranges or system pressures listed in table 6-1.

Table 6-1. Normal Operating Pressures

AMBIENT-DEGREES F	50°	75°	100°	125°
90°F DRY-BULB RETURN AIR TO UNIT				
Suction line (psig)	58-65	58-70	60-75	75-90
Discharge line (psig)	125-160	175-210	255-295	370-410
80°F DRY-BULB RETURN AIR TO UNIT				
Suction line (psig)	58-65	58-70	60-75	65-75
Discharge line (psig)	120-155	170-205	250-290	370-410

Note. Dry-bulb temperatures are measured with an ordinary thermometer.

### 6-15. Leak-Testing Refrigerant System

a. *Electric or Halide Torch Leak Detector.* The preferred method of testing for leaks in the refrigerant system is by using a halide torch. A halide detector is used by passing the exploring tube over sweat-soldered fittings, all mechanical couplings, and valves. If refrigerant is leaking from the system, the flame of the halide torch

will change from blue to green when the leak is small. If the leak is large, the flame will be dense blue with a reddish tip; or, a large leak may extinguish the torch. Mark all spots where leaks are detected. Drain the refrigerant system and repair the leak, and pressure test (para 6-28, 29, 30).

*Warning:* Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas. Be especially careful that Refrigerant-22 does not come in contact with the eyes. In case of refrigerant leaks, ventilate the area immediately.

b. *Soap Solution Method.* Operate the air conditioner, brush all possible points or leakage with soap solution, and watch for bubbles. Follow a definite sequence so all points will be thoroughly tested. Wipe the soap solution from all joints and mark any spot where a leak occurs. Drain the refrigerant system and repair leaks and pressure test (para 6-28, 29, 30).

### 6-16. Refrigerant Tubing and Fittings

a. The refrigerant tubes used on the air conditioner consist of copper tubing and the necessary fittings. The joints of the refrigerant tubes are soldered. Inspect the tubing for cracks and breaks. Replace any defective tubing with tubes of the same length, size, shape, and material. Test the installation of tubes and fittings for leaks. Replace rubber insulation as necessary.

Note. If the refrigerant system has been open to the atmosphere, replace the dehydrator (para 6-31). Pressure test and evacuate the system before charging (para 6-28, 29, 30).

b. If the refrigerant system must be opened for repairs or replacement of parts, open the suction line access valve and relieve the system pressure. Connect a hose line to the suction line access valve and purge the refrigerant to an outside area.

*Warning:* Avoid bodily contact with liquid Refrigerant-22 and avoid inhaling refrigerant gas. Be especially careful that Refrigerant-22 does not contact the eyes. In case of refrigerant leaks, ventilate the area immediately.

c. After purging the system allow the tubing to warm to ambient temperature before opening the system; this delay will help prevent the for-

suction of condensation on the inside walls of the tubing. Plug or cap all openings as a part is removed to minimize the entry of dirt and moisture.

d. Use a silver solder on all soldered connections. Easy-Flo silver solder (or equivalent) with a 50 percent silver capacity and a melting point of approximately 1160°F is recommended. Continually pass dry nitrogen through the tubing or connections being soldered to prevent formation of harmful copper oxides.

e. After assembly of any flanged joint, apply one coat of Amer-coat No. 40 to the joint.

f. After assembly of piping, coat all copper-to-aluminum joints with 3 coats Amer-coat No. 40 for a distance of one inch on each side of joint as well as the joint.

*Note.* Amer-coat may be force dried at a maximum temperature of 140°F.

g. When removing and installing the solenoid valves, direct flame away from the valve body to protect it from heat damage. Keep the flame on the outside of the distributor when disassembling or reassembling the expansion valve.

h. No metal to metal contact is allowable on capillary tubes; use tape to prevent such contact.

## 5-17. Thermal Expansion Valves

a. *General.* A 4 1/2-ton thermal expansion valve controls the rate of flow of liquid refrigerant into the evaporator coil during the cooling cycle of operation. The 2.1 ton thermal expansion valve functions when the unit is in the bypass cycle of operation. Each expansion valve is provided with a superheat setting or adjustment (10°F for each model) to assure efficiency in the refrigerant system.

*Note.* A gas is superheated whenever its temperature is higher than the temperature corresponding to its pressure at saturation. Example: Refrigerant-22 at 69 pounds pressure has a temperature of 40°F. If the suction pressure gauge reads 69 pounds and the temperature of the suction tube reads 50°F, the gas is superheated 10°F.

b. *Adjustment.* Refer to figures 6-10 and 6-11 and check and adjust the superheat setting of the 4 1/2-ton thermal expansion valve. The 2.1 ton thermal expansion valve adjusts in the same manner.

### c. Testing.

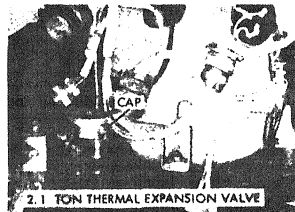
(1) Stop the air conditioner and allow the suction line to warm up to ambient temperature. Remove the sensing bulb from its location against the suction line and place in an ice-water bath (32°F).

(2) Start the air conditioner, remove the sensing bulb from the ice-water bath and warm

suction line temperature drops, the valve is operating correctly. Stop air conditioner and reinstall the sensing bulb.

(3) If there is little or no change in suction line temperature, the valve is defective and must be replaced.

**Caution:** Do not warm sensing bulb in hand longer than necessary to check operation of the valve. The valve is wide open or nearly so during this procedure and excessive flood-back of liquid refrigerant into the suction line will damage the compressor.



**NOTE:** REMOVE TOP COVER PANEL AND FOLLOW SAME PROCEDURE TO ADJUST 4-1/2 TON THERMAL EXPANSION VALVE.

### ADJUSTMENT:

- STEP 1. TAPE THE BULB OF A THERMOMETER TO SUCTION LINE NEAR SENSING ELEMENT. INSULATE THERMOMETER BULB.
- STEP 2. INSTALL A SUITABLE PRESSURE GAGE AT SUCTION LINE ACCESS VALVE (PAR. 6-14).
- STEP 3. OPERATE THE UNIT ON "COOL" FOR APPROXIMATELY 30 MINUTES (THERMOMETER READING MUST STABILIZE).
- STEP 4. CHECK THERMOMETER AND PRESSURE GAGE READINGS. COMPARE READINGS WITH FIGURE 6-11. THERMOMETER READING SHOULD BE APPROXIMATELY 10°F HIGHER THAN TEMPERATURE GIVEN ON FIGURE.
- STEP 5. REMOVE CAP, LOOSEN NUT AND TURN ADJUSTING SCREW ONE TURN CLOCKWISE TO INCREASE SUPERHEAT 4°F, OR ONE TURN COUNTERCLOCKWISE TO DECREASE SUPERHEAT. INSTALL CAP.

e. *Installation.* Replace defective expansion valves and install in reverse order of removal as illustrated in figure 5-7. Evacuate and recharge the unit refrigerating system (para 6-28, 29, 30).

## 6-18. Hot Gas Bypass Solenoid Valve

a. *General.* The hot gas bypass solenoid valve is a normally open, pilot operated valve which remains closed while the selector switch is on "COOL". The hot gas bypass valve opens whenever the selector switch is moved to another position, bypassing refrigerant gas under pressure in the discharge line to the compressor suction line. Moving the selector switch to "COOL" permits the hot gas bypass valve to close after the 30-second delay provided by the time delay relay.

### b. On-Equipment Testing.

(1) Start the air conditioner. If the valve clicks closed, place hand on the downstream piping. If the piping begins to cool immediately, the valve is operating properly. Replace valve if it does not operate as specified.

(2) If the hot gas bypass solenoid valve fails to click closed after a 30-second delay, stop

electrical plug connector. Test the hot gas bypass control coil at the electrical receptacle connector, placing a continuity tester or a multimeter set on low OHM range, across each pin. If continuity does not exist, remove valve and repair or replace control coil.

(4) Using a multimeter set on high OHMS range, measure resistance between one of the jack pins and the air conditioner frame. If resistance reading is less than 0.5 megohm, remove valve and repair or replace control coil.

c. *Removal and Disassembly.* Discharge refrigerant system (para 6-28), refer to figure 5-8 and remove and disassemble the hot gas bypass solenoid valve.

**Caution:** Disassemble valve before attempting to remove tubing from valve to avoid heat distortion of internal parts.

d. *Reassembly and Installation.* Replace any defective parts. Reassemble valve and install in reverse order of removal as illustrated on figure 5-8. Test, evacuate and recharge the refrigerant system (para 6-28, 29, 30).

## 6-19. Liquid Line Solenoid Valve

a. *General.* The liquid line solenoid valve is a normally open pilot operated valve which automatically closes and opens on command from the air conditioner temperature control thermostat when the selector switch is on "COOL" position. In the open position, the liquid line solenoid valve allows flow of liquid refrigerant from the condenser to the evaporator coil. In the closed position, the liquid line solenoid valve blocks the flow of liquid refrigerant to the evaporator coil.

### b. On-Equipment Testing.

(1) Turn the temperature selector thermostat 5°—10°F below ambient temperature to assure refrigerant system will operate on the cooling cycle. Start air conditioner and place hand on the downstream piping. If the piping begins to warm immediately, the valve is operating properly. Replace valve if it does not operate as specified.

(2) Turn temperature control thermostat 5°—10°F above ambient temperature to place refrigerant system on bypass cycle. The liquid line solenoid valve should immediately click closed. Place hand on the downstream piping. If the piping begins to cool immediately the valve is operating properly. Replace valve if it does not operate as specified.

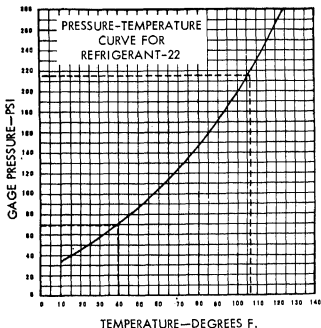


Figure 6-11. Pressure temperature curve for Refrigerant-22.

(3) If valve fails to click closed, stop air conditioner and test valve according to instructions in paragraph 6-18.

*c. Removal and Disassembly.* Discharge refrigerant system (para 6-28). Refer to figure 5-8 and remove and disassemble the liquid line solenoid valve.

**Caution:** Do not remove tubing from valve to avoid heat distortion of integral parts.

*d. Reassembly and Installation.* Replace any defective parts. Reassemble valve and install in reverse order of removal as illustrated on figure 5-8. Test, evacuate and recharge the refrigerant system (para 6-28, 29, 30).

## 6-20. Back Pressure Regulating Valve

*a. General.* The back pressure regulating valve (fig. 5-9), regulates refrigerant pressure in the evaporator to prevent coil freeze up. Valve is preset to establish a minimum pressure of 57.8 psig in the evaporator. The back pressure regulating valve also bypasses refrigerant gas from the discharge line to the suction line during bypass operation with the selector switch on "COOL".

*b. Adjusting.* Remove button plug from the back pressure regulating valve, (fig. 5-9), loosen the lock nut at the top of the valve and turn the adjusting screw. Tighten the lock nut after adjustment and check system operating pressures (para 6-14).

*c. Removal.* Refer to figure 5-9, and remove the back pressure regulator valve.

*Note.* Discharge the refrigerant before removing back pressure valve.

*d. Installation.* Replace a defective back pressure regulating valve and install in reversing order of removal as illustrated on figure 5-9. Test, evacuate and recharge refrigerant system (para 6-28, 29, 30).

## 6-21. High and Low Pressure Cutout Switches

*a. General.* The high pressure cutout switch prevents the compressor from operating if the head pressure exceeds 445 psig (pounds per square inch gage). The low pressure cutout switch prevents the compressor from operating if the suction line pressure drops below 7 psig.

*b. Removal.* Discharge the refrigerant system and remove high and low pressure cutout switches as illustrated in figure 5-10.

*c. Testing.* Test the pressure switches for continuity across the connector pins with a multimeter set on OHMS. If no continuity is indicated, press the reset button and recheck.

*d. Installation.* Replace defective pressure cutout switches in reverse order of removal as illustrated in figure 5-10. Test, evacuate and recharge the unit refrigerant system (para 6-28, 29, 30).

## 6-22. Pressure Relief Valve

*a. General.* The pressure relief valve (fig. 5-12) is located on a cross just above the dehydrator. The pressure relief valve protects the refrigerant system from excessive pressure. It is preset to open at a maximum pressure of 540 psig and is not adjustable.

*b. Removal.* Discharge the refrigerant system, refer to figure 5-12, and remove the pressure relief valve.

*c. Installation.* Replace a defective pressure relief valve by reversing order of removal as illustrated on figure 5-12. Pressure test, evacuate and recharge refrigerating system (para 6-28, 29, 30).

## 6-23. Evaporator Coil

*a. General.* The evaporator coil is mounted on the casing, directly behind the discharge grille. The coil must be removed from the air conditioner for repair or replacement. The coil is made of brazed aluminum and is of the finned plate configuration.

*b. Removal.* Refer to figure 5-5 and remove evaporator coil.

*c. Cleaning, Inspection and Repair.* Refer to paragraph 3-10 and clean and inspect the evaporator coil in a similar manner. Inspect coil for bent fins, damaged coil runs and internal leaks. Straighten bent fins with needle nose pliers. A damaged coil or an internally leaking coil cannot be repaired.

*d. Installation.* Replace a defective evaporator coil assembly and install in reverse order of removal as illustrated in figure 5-5. Test, evacuate and recharge refrigerating system (para 6-28, 29, 30).

## 6-24. Condenser Coil

*a. General.* The condenser coil is mounted horizontally on the bottom third of the casing, beneath the air filters. The coil must be removed from the air conditioner for repair or replacement. The coil is made from brazed aluminum and is of the finned plate configuration.

*b. Removal.* Refer to figure 5-13, and remove condenser coil.

*c. Cleaning, Inspection, and Repair.* Refer to paragraph 3-11 and clean and inspect the condenser coil in a similar manner.

*d. Installation.* Replace a defective coil assembly and install in reverse order of removal as illustrated in figure 5-13. Test, evacuate and recharge refrigerating system (para 6-28, 29, 30).

## 6-25. Systems Access Valves

*a. General.* Two angle-type access valves (suction line and discharge line) provide access to the refrigerant system.

*b. Removal.* Discharge the refrigerant system and refer to figure 5-11 and remove the access valves.

*c. Installation.* Replace a defective valve and install valves in reverse order of removal as illustrated in figure 5-11. Test, evacuate and recharge the unit refrigeration system (para 6-28, 29, 30).

## 6-26. Compressor and Motor Assembly

*a. General.* The sole purpose of the compressor is to raise the pressure of refrigerant gas from evaporator pressure to condensing pressure. The function of the compressor is to deliver refrigerant to the condenser at a pressure and temperature at which the condensing process can readily be accomplished. The motor/compressor is a hermetically sealed unit and is not repairable in the field. An inoperative compressor is usually due to a mechanical failure causing the compressor to freeze, a control failure, or a motor burnout. If the motor/compressor is mechanically frozen or there has been a motor burnout, the compressor must be removed and replaced. When the motor of a hermetic compressor fails, high temperatures may develop within the compressor causing a breakdown of the oil and refrigerant, resulting in formation of acid, moisture, and sludge. All these are extremely corrosive and must be flushed from the system. Repeated burnouts will occur if all of the contaminants are not removed.

*b. Cleaning and Inspection.* The immediate area around the compressor mounting should be thoroughly cleaned and dried. Examine all con-

nections for foreign matter of any kind. Inspect area thoroughly.

**Warning:** Avoid bodily contact with the refrigerant, especially eye contact. Avoid inhalation of refrigerant fumes.

*c. Removal.* Discharge the refrigerant system, refer to figure 5-6, and remove the compressor. If there has been a burnout, flush system as described in *e* below prior to installation of new compressor.

*d. Installation.* Install a replacement compressor in reverse order of removal, as illustrated in figure 5-6. Pressure test, evacuate and recharge refrigerating system (para 6-28, 29, 30).

*e. Flushing The System.* After compressor motor burnout, flush the system as described below:

(1) Refrigerant-11, along with a small amount of dry nitrogen to force the refrigerant through the tubing, is recommended for flushing the system.

(2) Remove the dehydrator as described in paragraph 5-31.

(3) Flush the refrigerant tubing to remove all contaminants.

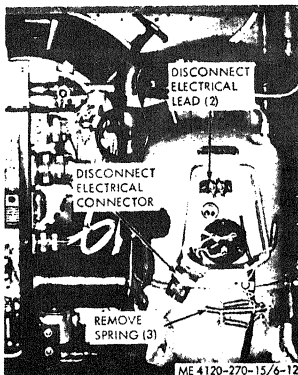
(4) The liquid line bypass and the hot gas bypass valves are normally open when deenergized. These valves must be open to allow the flushing refrigerant to flow through the tubing.

## 6-27. Compressor Crankcase Heater

*a. General.* The compressor crankcase heater is designed to prevent refrigerant sludging. It provides heat to prevent sludging and oil pumping problems when the compressor is exposed to low ambient temperatures. It is a 208 volt, 120 watt resistance heater enclosed within tubing and protected by a thermally insulated cover.

*b. Removal.* Refer to paragraph 5-24, and remove the compressor. Refer to figure 6-12 and remove the crankcase heater.

*c. Installation.* Replace defective heater and install in reverse order of removal as illustrated in figure 6-12. Refer to paragraph 5-24, and install the compressor. Test, evacuate and recharge the refrigerant system (para 6-28, 29, 30).



*Figure 6-18. Compressor crankcase heater, removal and installation.*

### **Section III. DISCHARGING, PRESSURE TESTING, EVACUATING AND RECHARGING THE REFRIGERANT SYSTEM**

#### **6-28. Discharging the Refrigerant System**

Attach a suitable hose to the suction line access valve (fig 5-11) and discharge the refrigerant into a safe area.

**Warning:** Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas. Be especially careful that Refrigerant-22 does not come in contact with the eyes. In case of refrigerant leaks, ventilate the area immediately.

#### **6-29. Pressure Testing and Evacuating the Refrigerant System**

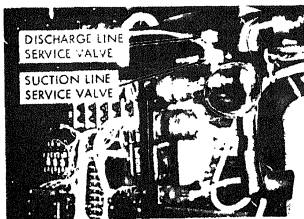
Discharge system (para 6-16). Refer to figure 6-13), and pressure test and evacuate the refrigerant system.

#### **6-30. Charging the Refrigerant System**

Refer to figures 6-14 and 6-15; charge the refrigerant system.

**Note.** Capacity of refrigerant system is 26.9 lb Refrigerant-22 FSN 6830-174-9677.



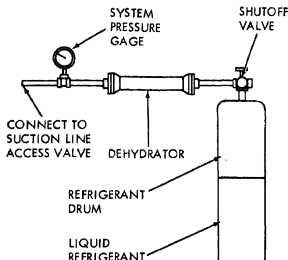


**WARNING:** AVOID BODILY CONTACT WITH LIQUID REFRIGERANT AND AVOID INHALING REFRIGERANT GAS. BE ESPECIALLY CAREFUL THAT REFRIGERANT-22 DOES NOT CONTACT EYES, IN CASE OF REFRIGERANT LEAKS, VENTILATE THE AREA IMMEDIATELY.

- STEP 1.** CLOSE SERVICE VALVES HAND-TIGHT. REMOVE CAP FROM SUCTION LINE SERVICE VALVE. INSTALL PRESSURE GAGE ON DISCHARGE LINE SERVICE VALVE AND OPEN VALVE.

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**Figure 6-13 (1).** Pressure testing and evacuating refrigerant system.

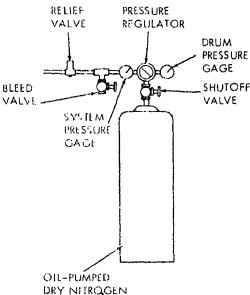


- STEP 2.** CONNECT HOSE FROM REFRIGERANT CHARGING HOOKUP LOOSELY TO SUCTION LINE SERVICE VALVE. OPEN REFRIGERANT DRUM SHUTOFF VALVE SLIGHTLY TO PURGE HOSE. TIGHTEN CONNECTION AT SERVICE VALVE. OPEN DRUM SHUTOFF VALVE AND OPEN SUCTION LINE SERVICE VALVE.
- NOTE:** REFRIGERANT DRUM MUST BE IN UPRIGHT POSITION TO ALLOW ONLY GASEOUS REFRIGERANT TO ENTER SYSTEM.

- STEP 3.** CLOSE THE DRUM SHUTOFF VALVE WHEN THE DISCHARGE LINE PRESSURE GAGE REACHES 10 PSIG. CLOSE SUCTION LINE SERVICE VALVE AND DISCONNECT CHARGING HOSE FROM VALVE.

- STEP 4.** CONNECT HOSE FROM PRESSURE TESTING HOOKUP LOOSELY TO SUCTION LINE SERVICE VALVE. OPEN NITROGEN DRUM SHUTOFF VALVE SLIGHTLY TO PURGE HOSE. TIGHTEN CONNECTION AT SUCTION LINE SERVICE VALVE. OPEN SHUTOFF VALVE AND SUCTION LINE SERVICE VALVE. BUILD UP SYSTEM PRESSURE UNTIL DISCHARGE LINE PRESSURE REACHES 150 PSIG. CLOSE SUCTION LINE SERVICE VALVE AND SHUTOFF VALVE. DISCONNECT CHARGING HOSE FROM SUCTION LINE SERVICE VALVE. CLOSE DISCHARGE LINE SERVICE VALVE AND REMOVE GAGE.

- STEP 5.** TEST FOR LEAKS (PAR. 6-15). DISCHARGE THE REFRIGERANT SYSTEM (PAR. 6-16).



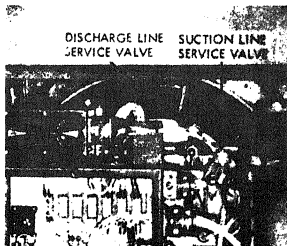
STEP 6. REMOVE CAP FROM DISCHARGE SERVICE VALVE. ATTACH A SUITABLE VACUUM PUMP TO SUCTION LINE SERVICE VALVE AND A MANOMETER TO THE DISCHARGE LINE SERVICE VALVE. OPEN THE SERVICE VALVES AND OPERATE THE VACUUM PUMP UNTIL THE MANOMETER INDICATES 2.6 MM HG. ABS. (MILLIMETERS OF MERCURY, ABSOLUTE).

STEP 7. CLOSE THE SUCTION LINE SERVICE VALVE AND STOP THE PUMP. ATTACH HOSE FROM REFRIGERANT DRUM, PURGE AIR FROM LINE WITH REFRIGERANT AND SLOWLY BREAK THE VACUUM BY OPENING THE SUCTION LINE SERVICE VALVE UNTIL MANOMETER INDICATES 760 MM HG. ABS. CLOSE SUCTION SERVICE VALVE. RISE IN PRESSURE WILL BE INFLUENCED BY AMBIENT TEMPERATURE. MAKE SURE VACUUM IN SYSTEM IS COMPLETELY RELIEVED BEFORE RE-EVACUATING.

STEP 8. REMOVE REFRIGERANT DRUM AND CONNECT VACUUM PUMP TO SUCTION LINE SERVICE VALVE. PURGE AIR FROM HOSE, START PUMP AND OPEN SUCTION LINE SERVICE VALVE. OPERATE PUMP UNTIL MANOMETER AGAIN READS 2.5 MM HG. ABS.

STEP 9. CLOSE SUCTION LINE SERVICE VALVE AND ALLOW UNIT TO STAND UNDER VACUUM FOR APPROXIMATELY 12 HOURS. IF NO NOTICEABLE RISE IN PRESSURE OCCURS, THE SYSTEM IS READY FOR CHARGING. CLOSE SERVICE VALVES AND REMOVE VACUUM PUMP AND MANOMETER. INSTALL SERVICE VALVE CAPS.

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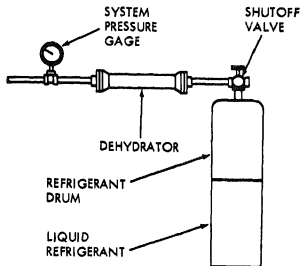


**WARNING:** AVOID BODILY CONTACT WITH LIQUID REFRIGERANT AND AVOID INHALING REFRIGERANT GAS. BE ESPECIALLY CAREFUL THAT REFRIGERANT-22 DOES NOT CONTACT THE EYES. IN CASE OF REFRIGERANT LEAKS, VENTILATE THE AREA IMMEDIATELY.

STEP 1. REMOVE CAPS FROM SERVICE VALVES.

ME 4120-270-15/6-14(1)

*Figure 6-14 (1). Charging refrigerant system.*

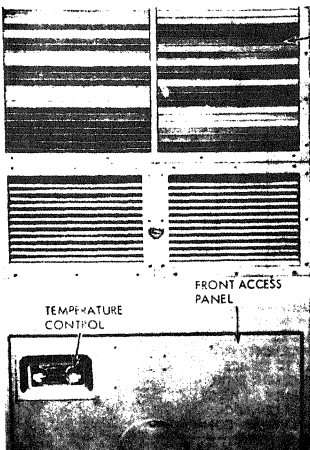


**STEP 2.** CONNECT A SUITABLE REFRIGERANT CHARGING PRESSURE MANIFOLD TO THE REFRIGERANT CHARGING HOOK-UP. CONNECT SERVICE HOSES FROM MANIFOLD LOOSELY TO SERVICE VALVES. OPEN REFRIGERANT DRUM SHUTOFF VALVE SLIGHTLY TO PURGE HOSES. TIGHTEN HOSE CONNECTIONS AT CHARGING VALVES. CONNECT A PRESSURE GAGE TO THE SUCTION LINE SERVICE VALVE.

**NOTE:** SET REFRIGERANT DRUM IN AN UPRIGHT POSITION SO THAT ONLY GASEOUS REFRIGERANT WILL ENTER SYSTEM. TO FACILITATE SPEED OF CHARGING, SET REFRIGERANT DRUM IN WARM WATER. NEVER USE A HEATING TORCH FOR THIS PURPOSE.

ME 4120-270-15/6-14 (2)

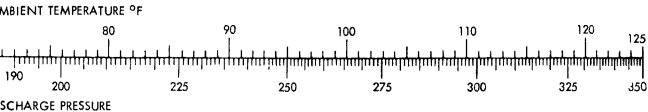
*Figure 6-14 (8)—Continued.*



- NOTE: SET TEMPERATURE CONTROL ABOVE AMBIENT TEMPERATURE TO INSURE UNIT OPERATES CONTINUOUSLY ON COOLING CYCLE.
- NOTE: OPEN REFRIGERANT DRUM SHUTOFF VALVE AND SERVICE VALVE. START UNIT (PAR. 2-11) AND WEIGHT IN 26.9 LB CHARGE OF REFRIGERANT-22. CONTINUE ADDING REFRIGERANT SLOWLY UNTIL SIGHT GLASS INDICATES FULL.
- NOTE: OPERATE UNIT IN "COOL" POSITION ONLY DURING CHARGING OPERATION.
- STEP 4. PARTIALLY BLOCK EVAPORATOR DISCHARGE GRILLE WITH A CARDBOARD BAFFLE. ADJUST BAFFLE UNTIL SUCTION LINE PRESSURE GAGE READS 55 PSIG. CONTINUE ADDING REFRIGERANT-22 SLOWLY, WHILE MAINTAINING 55 PSIG SUCTION PRESSURE BY ADJUSTING THE BAFFLE, UNTIL THE DISCHARGE PRESSURE GAGE READING OBTAINED CORRESPONDS TO THE AMBIENT TEMPERATURE (FIG. 6-15).
- STEP 5. CLOSE SERVICE VALVES AND CLOSE REFRIGERANT DRUM SHUTOFF VALVE. STOP THE UNIT (PAR. 2-12). DISCONNECT CHARGING MANIFOLD HOSES FROM SERVICE VALVES. INSTALL VALVE CAPS (STEP 1).

Figure 6-14 (5)—Continued.

DISCHARGE PRESSURE  
AT CONSTANT 55" PSIG SUCTION  
AMBIENT FROM 70°F TO 125°F



*Figure 6-15. Discharge pressures at constant 55 psi suction, ambient temperatures 70°F to 120°F.*



# CHAPTER 7

## SHIPMENT, ADMINISTRATIVE STORAGE AND DEMOLITION TO PREVENT ENEMY USE

### Section I. SHIPMENT AND ADMINISTRATIVE STORAGE

#### 7-1. General

The placement of equipment in administrative storage can be for short periods of time when a shortage of maintenance effort exists. Items placed in administrative storage should be ready for use within the time factors as determined by the directing authority. During the storage period, appropriate maintenance records will be kept.

#### 7-2. Preparation for Administrative Storage

Refer to TM 740-90-1, Administrative Storage of Equipment, for detailed instructions on preparation of the air conditioner for administrative storage and maintenance during storage.

#### 7-3. Preparation of Equipment for Shipment

*a. Preservation.* Clean, paint, preserve, and weatherproof in accordance with applicable requirement of TM 740-90-1.

*b. Packing.* Pack the basic issue items, components, and publications in a suitable container and secure to air conditioner. Refer to TM 38-230 for guidance in selection, fabrication, and packing of the container.

*c. Marking.* Mark in accordance with MIL-STD-129.

*d. Loading.* Load, block, brace, and tiedown heater in accordance with carrier rules and regulations.

### Section II. DEMOLITION OF MATERIAL TO PREVENT ENEMY USE

#### 7-4. General

*a.* When capture or abandonment of the air conditioner is imminent, the responsible unit commander must make the decision either to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of demolition. Whatever method of demolition is employed, it is essential to destroy the same vital parts of air conditioner and all corresponding repair parts. When the lack of time or personnel prevents complete destruction of the equipment, the following priorities will be used in the demolition of essential parts. Priorities for demolition:

Priorities	Parts
1 -----	Evaporator coil and condenser coils
2 -----	All motors
3 -----	Compressor
4 -----	Tubing
5 -----	Cables and wiring

*b.* The above priorities were established by International Standardization Agreement.

be made from the agreement without permission of the Military Agency for Standardization, North Atlantic Treaty Organization.

#### 7-5. Demolition to Render the Equipment Inoperative

*a. Demolition by mechanical means.* Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available.

*b. Demolition by misuse.* Perform the following steps to render the air conditioner inoperative.

(1) Loosen compressor discharge and suction valve attaching bolt and run compressor until it fails.

(2) Bend fan blades housing to prevent fan blades from turning.

#### 7-6. Demolition by Explosive or Weapons Fire

*a. Explosive.* Place as many of the charges as the situation permits, and detonate them simultaneously with a detonating cord and a suitable

b. *Weapons fire.* Fire on the air conditioner, using the heaviest practical weapon available.

#### **7-7. Other Demolition Methods**

a. *Scattering and Concealment.* Remove all easily accessible parts and wiring, and scatter them through dense foliage, bury them, or throw them in a body of water.

b. *Burning.* Pack rags, clothing, or paper under and around the air conditioner. Saturate this packing with gasoline, oil, or diesel fuel, and ignite.

c. *Submersion.* Completely submerge the air conditioner in a body of water to provide water damage and concealment. Salt water does greater damage to metal parts than fresh water.

#### **7-8. Training**

All operators should receive thorough training in the demolition of the air conditioner. Refer to FM 5-25. Simulated demolition using all of the methods listed above should be included in the operator-training program. It must be emphasized, in training, that demolition operations are usually necessitated by critical situations when time available for carrying out demolition is limited. For this reason, operators must be thoroughly familiar with all methods of demolition of equipment and must be able to carry out demolition instructions without reference to this or any other manual.



## **APPENDIX A**

### **REFERENCES**

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#### **A-1. Painting**

TM 9-218

Painting Instructions for Field Use

#### **A-2. Radio Suppression**

TM 11-488

Radio Interference Suppression

#### **A-3. Maintenance**

TM 38-750

Army Equipment Record Procedures

TM 5-764

Electric Motor and Generator Repair

#### **A-4. Shipment and Storage**

TB 740-98-2

Preservation of USAMEC Mechanical Equipment for Shipment and Storage

TM 740-90-1

Administrative Storage of Equipment

TM 38-230

Preservation, Packaging, and Packing of Military Supplies and Equipment



## APPENDIX B

### BASIC ISSUE ITEMS LIST

#### Section I. INTRODUCTION

##### B-1. Scope

This appendix lists items which accompany the air conditioner or are required for installation, operation, or operator's maintenance.

##### B-2. General

This Basic Issue Items List is divided into the following sections:

*a. Basic Issue Items—Section II.* A list of items which accompany the air conditioner and are required by the operator/crew for installation, operation, or maintenance.

*b. Maintenance and Operating Supplies—Section III.* (Not applicable)

##### B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

*a. Source, Maintenance, and Recoverability Codes (SMR), Column (1):*

(1) Source code, indicates the selection status and source for the listed item. Source code is:

Code	Explanation
P	Applied to repair parts which are stocked in or supplied from GSA/DSA or Army supply system, and authorized for use at indicated maintenance categories.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Operator/crew

*b. Federal Stock Number, Column (2).* This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

*c. Description, Column (3).* This column indicates the Federal item name and any additional description of the item required. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis.

*d. Unit of Measure (u/m), Column (4).* A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

*e. Quantity Incorporated in Unit, Column (5).* This column indicates the quantity of the item used in the functional group or the assembly group.

*f. Quantity Furnished With Equipment, Column (6).* This column indicates the quantity of an item furnished with the equipment.

*g. Illustration, Column (7).* This column is divided as follows:

(1) *Figure Number, Column (7)(a).* Indicates the figure number of the illustration in which the item is shown.

(2) *Item Number, Column (7)(b).* Indicates the callout number used to reference the item in the illustration.

##### B-4. Federal Supply Code for Manufacturers

Code	Manufacturer
96906 ----	Military Standards
97403 ----	Army Engineers Research and Development Laboratories, Ft. Belvoir, Va.

# Section II. BASIC ISSUE ITEMS

(1) SMB Code	(2) Federal stock number	(3) Description	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration	
						(A) Fig No.	(B) Item No.
PC	5220-559-9618	CASE: Maintenance and operational manuals, cotton duck, water repellent, mildew resist- ant, MIL-B-11743B	ea		1		
PC		Department of the Army Operator Organiza- tional, Direct and General Support and Depot	ea		1		
PC		Maintenance Manual TM 5-4120-270-15	ea		1		
PC		Blockoff Plate, remote control operation 13214E3865-2 (97408) Connector, Plug MS3106R32-17S (96906)	ea		1		

## APPENDIX C

### MAINTENANCE ALLOCATION CHART

#### Section I. INTRODUCTION

##### C-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III not applicable.

d. Section IV not applicable.

##### C-2. Explanation of Columns in Section II

a. *Group Number, Column (1).* The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TM 750-93-1, Functional Grouping Codes) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. *Functional Group, Column (2).* This column contains a brief description of the components of each functional group.

c. *Maintenance Functions, Column (3).* This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

C—Operator or crew

O—Organizational maintenance

F—Direct support maintenance

H—General support maintenance

D—Depot maintenance

The maintenance functions are defined as follows:

A—Inspect: To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B—Test: To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C—Service: To clean, to preserve, to charge to paint, and to add fuel, lubricants, cooling agents, and air.

D—Adjust: To rectify to the extent necessary to bring into proper operating range.

E—Align: To adjust specified variable elements of an item to bring to optimum performance.

F—Calibrate: To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G—Install: To act up for use in an operational environment such as an emplacement, site, or vehicle.

H—Replace: To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I—Repair: To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J—Overhaul: To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

K—Rebuild: To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original man-

ufacturing tolerances and specifications, and subsequent reassembly of the item.

d. *Tools and Equipment, Column (4).* This column is provided for referencing by code the special tools and test equipment, (sec. III) re-

quired to perform the maintenance functions (sec. II).

e. *Remarks, Column (5).* This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

## Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional group	(3) Maintenance functions										(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K	
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	
40	ELECTRIC MOTORS												
4000	Motor assembly:												
	Motor assy, condenser -----	--	O	--	--	--	--	--	O	F			
	Motor assy, evaporator -----	--	O	--	--	--	--	--	O	F			
4002	Stator assemblies:												
	Stator, blower motor -----	--	F	--	--	--	--	--	F				
4006	Starting & protective devices:												
	Protector overload -----	--	F	--	--	--	--	--	F				
4009	Control panels, housing, cubicles:												
	Control panel assembly -----	--	--	--	--	--	--	--	F	F			
52	REFRIGERATION & AIR CONDITION- ING COMPONENTS												
5200	Gas compressor assembly:												
	Compressor assembly -----	--	F	F	--	--	--	--	F				
5217	Refrigerant piping:												
	Tubing, copper -----	--	F	--	--	--	--	--	F				
	Valve, regulating -----	--	F	--	F	--	--	--	F				
	Valve, solenoid -----	--	F	--	--	--	--	--	F	F			
5230	Condenser:												
	Condenser assembly -----	--	F	O/C	--	--	--	--	F				
5241	Evaporator:												
	Eliminator, mist -----	--	--	O/C	--	--	--	--	O				
	Evaporator assembly -----	--	F	--	--	--	--	--	F				
	Valve, expansion -----	--	F	--	F	--	--	--	F				
5245	Air Filters:												
	Filters -----	--	--	O/C	--	--	--	--	O				

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**By Order of the Secretary of the Army:**

**W. C. WESTMORELAND,**  
*General, United States Army,*  
*Chief of Staff.*

**Official:**

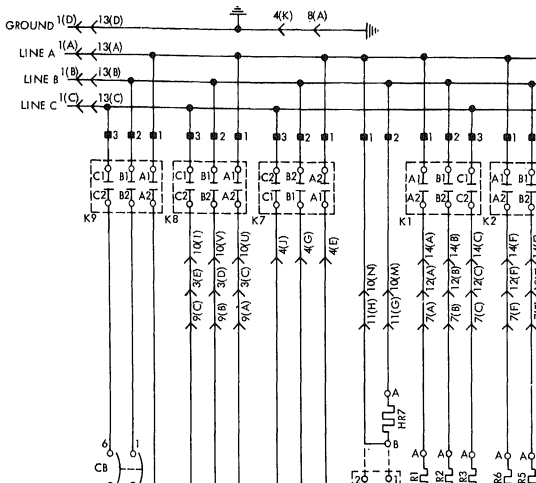
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*Major General, United States Army.*  
*The Adjutant General.*

**Distribution:**

To be distributed in accordance with DA Form 12-25, Sec III (qty rqr Block #574), **Organizational maintenance requirements for Environmental Equipment: Air Conditioners, 60,000 BTU.**

\* U.S. GOVERNMENT PRINTING OFFICE: 1990 - 261-912 (30342)

POWER  
SUPPLY  
208 VOLT  
3 PHASE  
60 OR 400  
CYCLE



## **SAFETY PRECAUTIONS**

### **Before Operation**

Disconnect air conditioner from power source before performing maintenance on components of unit.

### **During Operation**

If air conditioner is stopped during operation, wait 5 minutes before restart.

### **After Operation**

Disconnect air conditioner from power source before performing maintenance on components of unit.

Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas. Be careful that refrigerant-22 does not contact eyes. In case of leaks, ventilate area immediately.